

EKATI DIAMOND MINE

2008 AIR QUALITY MONITORING PROGRAM

EKATI Diamond Mine
BHP Billiton Canada Inc.
JULY 2011



BHP Billiton Canada Inc.
Operator of the EKATI Diamond Mine



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August 3, 2011

To: Distribution List

BHP Billiton's UPDATED Report on Air Quality at the Ekati Diamond Mine

BHP Billiton Canada Inc. is pleased to provide you with an updated *2008 Air Quality Monitoring Program* (AQMP) report. This revision incorporates suggestions from a peer review of the 2008 AQMP report conducted in March 2010. This update is intended to replace the original issuance of the 2008 AQMP report as a complete document for your records.

We trust that you find this update satisfactory, and look forward to providing the next 3 year AQMP report in spring 2012.

Yours sincerely,

BHP Billiton Canada Inc.

A handwritten signature in black ink, appearing to read 'Keith McLean', with a stylized flourish at the end.

Keith McLean, Superintendent-Environment Operations
Ekati Diamond Mine

Attachments:

1. 2008 Air Quality Monitoring Program Report



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Air Quality monitoring Program, 2008 Report

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January 18, 2010

To: distribution list

BHP Billiton's Report on Air Quality at the EKATI Diamond Mine

BHP Billiton Diamonds Inc. (BHP Billiton) is pleased to provide you with the report *2008 Air Quality Monitoring Program*. This is a 3-year report that provides the results for air quality around the EKATI mine from 2006 to 2008. We hope that you will find the report interesting and informative.

As expected, this report shows that the mine has small effects on air quality close to the mine site. The distance of these effects from the mine site are less than about 1 km for heavier dust particles from roads and less than about 15 km for smaller particles from other sources. This is close to what was predicted in 1995 and again in 2005. Even close to the mine site, the effects are referred to as "small" because they are less than the relevant guideline or reference values.

BHP Billiton is proud of how successful the *Air Quality Monitoring Program* has been. At the same time, BHP Billiton wants to keep improving the program and to build upon the strong interest that many people have shown in air quality.

BHP Billiton looks forward to continuing to talk about and advance the program.

Sincerely,

BHP Billiton Diamonds Inc.



for David Abernethy, Superintendent – Environment Operations
EKATI Diamond Mine

EKATI DIAMOND MINE

2008 AIR QUALITY MONITORING PROGRAM

July 2011
Project #0648-04901

Citation:

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Prepared for:



BHP Billiton Canada Inc.

Prepared by:



Rescan™ Environmental Services Ltd.
Yellowknife, Northwest Territories

Summary

Summary

The Air Quality Monitoring Program (AQMP) at EKATI is a requirement under Section VII of the Environmental Agreement to which the signatories are BHP Billiton, the Government of Canada and the Government of the Northwest Territories. In accordance with that agreement and commitments made in the 1995 Environmental Impact Statement, BHP Billiton initiated an AQMP in 1998 to support the management of air quality throughout the life of EKATI mining operations.

Summary results of the AQMP are reported each year in the Annual Environmental Agreement and Water License Report. Every three years in concert with an extended sampling program, a separate AQMP report is prepared that presents and interprets AQMP results in more detail. This current report provides and assesses results for the period from 2006 to 2008. The AQMP consists of five components:

1. Meteorological monitoring;
2. Air emissions and Greenhouse Gas (GHG) calculations;
3. Ambient Air Quality Monitoring:
 - High Volume Air Sampling (HVAS); and
 - Continuous air monitoring.
4. Dustfall monitoring;
5. Snow chemistry monitoring; and
6. Lichen tissue monitoring.

Emissions calculations and HVAS have been conducted yearly since the start of the program, while snow and lichen sampling has been conducted every three years. Dustfall monitoring was initiated at EKATI in 2006 in response to a program wide review conducted by BHP Billiton, external consultants and government stakeholders.

A total of 195,174 tonnes of greenhouse gas emissions were calculated to be released as CO₂ equivalencies in 2008. The average annual greenhouse gas emissions from 2006 to 2008 were 198,899 tonnes of CO₂ equivalent. This is 20% less than that estimated during 2003 to 2005 (248,245 tonnes of CO₂ equivalent).

The results of total suspended particulates from the HVAS at the two stations were well below the annual Canadian Ambient Air Quality Objective (CAAQO) of 60 µg/m³ for the three monitoring years of this current AQMP. During the monitoring period (2006-2008) only two exceedances of the CAAQO daily ambient Total Suspended Particulate (TSP) standard (120 µg/m³) occurred. Both exceedances were observed at station TSP-3; one on July 19, 2008 of 259.4 µg/m³ and 267.5 µg/m³ on September 15, 2008. Following further reconciliation of field data sheets it was noted that on July 19, 2008 there was noticeable smoke from forest fires in the air. On September 15, the field data sheet noted the presence of excessive soiling; suggesting a high concentration of suspended particulates had been deposited. It is likely that external sources contributed to a spike in total suspended solids and the isolated exceedances of the CAAQO daily objective at TSP-3 on these dates.

A total of 33 snow samples were collected for chemical analysis. Results suggest that winter loading of TSS and a number of metals (e.g., Al, Cr, Fe) likely associated with fugitive dust and fine particulates

are detectable slightly above reference levels in a zone around the EKATI mine footprint. However, concentrations were observed to fall well within the range of reference concentrations within approximately 15 km of mining activity. Parameters associated with gaseous emissions and blasting (i.e., NO_3^- , SO_4^{2-} , NH_3) show no trend with distance from mining operations. In contrast most of the non-volatile metals and crustal elements, which tend to decline with distance from the mine site, sulphur and nitrogen concentrations substances seem to have a more generalized distribution.

A total of 37 lichen plots were sampled, many of which coincided with snow core and dustfall sampling sites to allow for comparisons. Statistics and spatial analysis of tissue data indicate results are consistent with snow chemistry data. Similar trends with respect to volatile and non-volatile compounds were observed. A qualitative assessment of spatial relationships indicates a zone of influence directly surrounding the mine. Concentrations of non-volatile compounds such as chromium and aluminum decline rapidly with distance from mining activity. Most of the sources of S and N in the lichen tissues are from depositional materials that can re-volatilize and accumulate in the Arctic. Concentrations of S and N in lichen tissue reflect local sources but also arctic haze and subsequent bioaccumulation.

The CALPUFF air dispersion model results compared favourably with observed field data (i.e., snow core chemistry, HVAS, lichen and dustfall). The modeled sulphate deposition contributions from EKATI, Misery, and Diavik are of the same magnitude as background levels beyond 3 to 5 km from the active mining areas.

Results from the 2006 to 2008 AQMP suggest that management measures implemented at EKATI are effective at mitigating the effects of the mine on air quality.

Acknowledgments

Acknowledgments

This report was prepared for BHP Billiton Canada Inc. by Rescan Environmental Services Ltd. The Project was managed by Marc Wen (M.Sc., R.P.Bio.) of Rescan. The Air Quality Monitoring Program was facilitated by EKATI Environment Advisors Leslie Coe and Julie Ellison. The field monitoring of dust was completed by EKATI Environmental personnel; in particular thanks go to Jamie Steele, Charles Klengenberg, Christina Lowing and Joseph Heron. Maintenance of the meteorological instrumentation was conducted by Rescan Environmental Services. The CAM building was maintained and calibrated by Maxxam Analytics Ltd. with support from EKATI. Snow sampling was conducted by EKATI staff, and lichen sampling was done by Stephen Ban (M.Sc.) and Katherine Enns (M.Sc.). The report was written by Joanne Willers (B.Sc.), Jason Rempel (M.Sc.) and Katherine Enns (Delphinium Holdings Inc.). Delphinium and their staff are acknowledged specifically for their lichen assessment (Appendix 3) and related contributions to the main text (Section 2.7 and 3.7).

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2008 AIR QUALITY MONITORING PROGRAM

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Acronyms and Abbreviations

Acronyms and Abbreviations

AEMP	Aquatic Effects Monitoring Program
BACI	Before-After-Control-Impact
BHP Billiton	BHP Billiton Canada Inc.
EKATI	EKATI Diamond Mine
WLWB	Wek'èezhii Land and Water Board

1. Introduction

1. Introduction

BHP Billiton Canada Inc. (BHP Billiton) has established an Air Quality Management and Monitoring Plan (BHP Billiton, March 2009) at the EKATI Diamond Mine (EKATI) to track potential effects of emissions and fugitive dust to soil, water, vegetation and human health and safety. The Plan was most recently updated and released in March 2009 to incorporate updated sample locations, sample methodologies and data analysis techniques.

Ambient air quality is a valued ecosystem component (VEC) at EKATI because of its importance for effects on worker health and safety, and its importance for wildlife, vegetation and water quality (BHP and DiaMet, 1995). Air quality also has aesthetic qualities in terms of visibility and odour. Local air quality issues can be affected by regional and global influences such as long range transport, arctic haze and acidic deposition (acid rain), automobile and diesel exhaust, forest fires and climate effects (climate change). These large scale atmospheric effects have been understood to collect and concentrate in the Arctic where they can be deposited as particulate (Cheng et al. 1993).

As a part of the 1995 Environmental Impact Statement (EIS) for the proposed EKATI Diamond Mine and in the Environmental Agreement, BHP Billiton committed to:

- adaptively manage ambient air quality through the implementation of an air quality monitoring plan approved by the Governments of Canada and the Northwest Territories; and
- refine the air dispersion modeling when upper air data became available.

The Air Quality Monitoring Program (AQMP) was initiated in 1998 and is ongoing. The purpose of the program is to monitor ambient air quality and to assess the effectiveness of air quality management plans in maintaining air quality throughout the life of EKATI mining operations. The results of the AQMP are benchmarked through comparison against:

- applicable ambient air quality guidelines;
- historical and reference air quality data generated at EKATI;
- baseline air quality parameters referenced in the literature; and
- air dispersion modeling predictions.

BHP Billiton continues to meet its commitments through the AQMP, and following availability of the high level air data in 2005, EKATI refined its air dispersion modelling (Rescan, 2006). Only preliminary results of the 2005 CALPUFF air dispersion modelling study were presented in the 2005 AQMP. Thus, the final results (which were released in 2006) are discussed in this report (Section 3.2).

Previous AQMP reports summarized data collected from 1998 to 2001 (ABR, 2002 and MDA, 2002) and 2003 to 2005 (Rescan, 2006). The objective of this report is to present and interpret results of air quality monitoring data collected from 2006 to 2008 as part of the AQMP.

During 2006, BHP Billiton undertook a thorough review of the AQMP program, and following consultation with the Independent Environmental Monitoring Agency (IEMA), Environment Canada's Environment Protection Division (EC EPD) and the Government of Northwest Territories Environment and Natural Resources Environmental Protection Services (GNWT ENR EPS), the AQMP was modified based on previous AQMP results at EKATI and up to date information on air quality monitoring

methodology. Sampling procedures and monitoring locations were revised and improved where necessary, and additional monitoring programs were initiated. Components of the AQMP that are summarized in this report include:

1. Meteorological monitoring;
2. Air emissions and greenhouse gas calculations;
3. Ambient air quality monitoring:
 - High Volume Air Sampling (HVAS)
 - Continuous air monitoring
4. Dustfall monitoring;
5. Snow chemistry monitoring; and
 - Lichen tissue monitoring.

Emissions calculations and HVAS were conducted each year since the commencement of the program in 1998, while snow and lichen sampling are generally conducted every three years (1998, 2001, 2005 and 2008).

The dustfall monitoring program was initiated in 2006 and has occurred during the summer months of each year of the current AQMP period (2006-2008). The results of the dustfall monitoring will be compared over time in future AQMP reports.

A Continuous Air Monitoring (CAM) building was originally installed in April 2007 adjacent to the Grizzly Lake pumping station. However, following consultation with regulatory agencies in 2008, the location of the station was moved to the west side of the mine site, near the Polar Explosives building to improve the ability of the CAM in detecting changes to air quality. Monitoring at this new location was initiated in October 2008.

1.1 EKATI AIR EMISSIONS

Air quality may be affected by particulate and gaseous emissions from stationary and mobile diesel powered heavy equipment and fugitive dust, which are all by-products of mining activities. Combustion of fossil fuels releases carbon dioxide (CO₂), methane (CH₄) and nitrous oxide (N₂O), which are greenhouse gases that are associated with global climate change (IPCC, 1995). BHP Billiton monitors GHG emissions from its operations and is seeking ways to make its operations more energy efficient and to reduce emissions. High ambient concentrations of particulate matter (especially fine particles <30 µm) from emissions and fugitive dust could, if not mitigated, have effects on wildlife and vegetation populations (Bell and Treshow, 2002). The goal of the EKATI AQMP is to provide the monitoring data that the mine needs to track ambient concentrations in order to determine if it is necessary to initiate adaptive management actions that would prevent adverse effects to the environment. The primary sources of particulate, gaseous emissions and fugitive dust at EKATI are:

- emissions from diesel-fired power generation;
- emissions from diesel fired boilers;
- vehicle traffic, including trucks, aircraft, and other mobile equipment on unpaved roads;
- mining activities, including blasting, and waste rock and ore handling; and
- waste management, including the incineration of solid and petroleum products.

EKATI has developed an air quality management plan to minimise air emissions. The plan includes proactive measures such as:

- use of low sulphur diesel fuel;
- preventative maintenance programs on machinery to ensure optimum operation of all combustion and fugitive emission sources;
- control of fugitive dust emissions through road watering, use of granite waste rock as construction materials and vehicle speed regulation;
- application of dust suppressant (DL10) to areas supporting heavy traffic volume in compliance with the Government of the Northwest Territories (GNWT) Environmental Guideline for Dust Suppression;
- application of Boeing approved EK35 dust suppressant on the EKATI airstrip; and
- the construction of a high efficiency incinerator.

1.2 SUMMARY OF ACTIVITY AT EKATI FROM 2006 TO 2008

During the 2006 to 2008 reporting period ore was extracted from two of the six open pit mines at EKATI: Beartooth and Fox. Underground mining at Koala and Panda also commenced. Waste rock was transported to storage areas adjacent to the pits, while ore was transported to the processing plant, located at the Main camp. After processing, kimberlite waste was separated into two size fractions. Coarse kimberlite waste was trucked to the Coarse Ore Storage Area, while fine kimberlite waste was pumped as a slurry to the Long Lake Containment Facility (LLCF). Figure 1.2-1 illustrates the extent of the EKATI mining footprint in 2009.

Active mining at the Misery Pit ceased during 2005. However, the remaining stockpiled Misery ore continued to be hauled to the processing plant during 2006 and early 2007. In October of 2007 hauling activity at the Misery pit was discontinued and no further ore handling and/or transportation occurred during the remainder of the AQMP monitoring period. As a result traffic along the Misery haul road during the summer of 2008 was greatly reduced from 2006 and 2007 levels.

1.3 SUMMARY OF DUST SUPPRESSION AT EKATI FROM 2006 TO 2008

Dust suppression mechanisms have been employed at EKATI since the commencement of mining in 1998 to mitigate the effects of fugitive dust. The EKATI Environment Department maintain records of the use of dust suppressants at the site. The use of water trucks for dust suppression on roads can be limited by weather conditions. This process is carefully managed by EKATI personnel each year.

A summary of dust suppression activities conducted for the current AQMP reporting period (2006 to 2008) is outlined below.

In 2006 water was used as a dust suppressant on the Misery Haul Road and DL-10 was used on the Fox and Beartooth Haul Roads. The dust suppressant EK-35 was used on the EKATI air strip in accordance with Boeing regulations to assist in the control of fugitive dust from incoming and outgoing aircraft and associated vehicle traffic.

Dust suppression on the Fox haul road consisting of both DL-10 and water commenced on June 8, 2007 and continued throughout the summer as required. Dust suppression on the Misery road consisted only of water, and occurred between June 15 and August 24, 2007.



In June 2008, the dust suppressant DL 10 was applied to the following areas on site:

- Main Camp (June 22nd);
- the road to the airport (June 23rd);
- above ground areas surrounding underground entrance/exits (June 25th); and
- Fox and Beartooth haul roads (June 27-28th).

A second application of DL-10 was applied on the Fox and Beartooth haul roads in August of 2008 as these roads experience high traffic volume. The use of water to suppress fugitive dust on Misery haul road was suspended in 2008 due to the lack of activity occurring at the Misery Pit during that year as opposed to previous years. Two applications of EK-35 were used on the EKATI airstrip in July 2008 (July 19-20th and July 26-27th) (Ellison pers com. 2009). Envirokleen is used as a dust suppressant when required to mitigate the effects of fugitive dust underground. A water truck was deployed periodically during the summer months in areas that are prone to the generation of high concentrations of fugitive emissions.

In addition to the application of the above dust suppressants EKATI continues to implement a reduced speed limit around site, which minimises the impact of vehicle road dust. Dust suppression mechanisms used during the 2006 to 2008 AQMP monitoring periods did not differ significantly from previous AQMP reporting periods.

2. AQMP Methodology

2. AQMP Methodology

Sampling procedures and monitoring locations of the AQMP were revised in the 2006 in consultation with IEMA, EC EPD, GNWT, ENR and EPS. The AQMP was modified based on previous AQMP results at EKATI and up to date information on air quality monitoring methodology.

The AQMP consists of six elements:

1. meteorological monitoring;
2. air emissions and greenhouse gas calculations;
3. ambient air quality monitoring:
 - High Volume Air Sampling (HVAS);
 - continuous air monitoring;
4. dustfall monitoring;
5. snow chemistry monitoring; and
 - o lichen tissue monitoring.

Dustfall monitoring commenced in 2006 and has been monitored annually. Emissions calculations and HVAS have been conducted annually in accordance with the National Pollutant Release Inventory (NPRI) and the Environmental Agreement, respectively. Snow and lichen sampling have been conducted every three years generally.

In general, sampling sites have been located in distinct areas close to the mine infrastructure and in areas considered as background. This sampling pattern will be used to assess spatial relationships with respect to the effects on air quality with distance from mining activity.

2.1 METEOROLOGY

Meteorology data is collected at EKATI from three sources. The Koala automated meteorological station has been in continuous operation since 1993. The station has sensors to monitor temperature, relative humidity, precipitation, and wind speed and direction. A micrometeorological station is operated on Polar Lake during the open-water season to provide data to estimate open water evaporation. Results from these two stations are reported annually as part of the Aquatic Effects Monitoring Program (AEMP). Weather observations are also collected by personnel at the EKATI airport. Data are only available for the hours the airport is staffed (generally 05:00 to 17:00 each day). Data from these observations are sent to the Meteorological Service of Canada, and are available for download from their website (<http://climate.weatheroffice.ec.gc.ca>).

A summary of the long-term data record at EKATI is provided in Chapter 3, highlighting specific aspects relevant to the AQMP. Results are based on data from the Koala meteorology station, which has the longest and most continuous data record for the site.

The Koala meteorology station's sensors are mounted on a 10 m high aluminum tower that is anchored to a concrete base and strengthened with guy wires. Wind speed is measured in metres per second (m/s) and wind direction in degrees from true north by a RM Young Model 05103 wind sensor. The temperature and relative humidity sensors are combined into one unit (Viasala HMP45C). The combination sensor is mounted on the tower protected from direct radiation by a multi-plate solar

radiation shield. Air temperature is measured in degrees Celsius and relative humidity in percent. During the open water season, precipitation is measured with a Sierra Misco 2500-P tipping bucket rain gauge (TBRG). During winter months, precipitation is measured with a Nipher snow gauge located adjacent to the station. The Nipher gauge is visited by BHPB staff approximately once every two weeks, and accumulated snow in the gauge is measured for snow-water-equivalent.

The sensors for the meteorology station are connected to a Campbell Scientific CR10X data-logger that controls the operation of the station. The data-logger's program monitors the sensors every five seconds and generates hourly and daily averages. The hourly and daily averages are stored in a memory storage module connected to the CR10X data-logger. The modules are changed out on a regular basis and downloaded. The station is powered with a 50 Watt solar panel and a 12 volt deep cycle marine battery, with the entire station grounded to prevent lightning from damaging the electronics.

2.2 AIR AND GREENHOUSE GAS EMISSIONS

Diesel fuel is consumed every year at EKATI for transportation of ore and waste rock, heat and production of electricity, blasting, and other mine activities. BHP Billiton calculates the air emissions resulting from the diesel fuel consumption, and reports them annually to the NPRI and the Canadian GHG Challenge Registry. The NPRI tracks criteria air contaminants (carbon monoxide, oxides of nitrogen, sulphur dioxide, volatile organic compounds (VOCs) and particulate matter (total, PM₁₀ and PM_{2.5}), while the GHG Challenge Registry tracks total GHG emissions (CO₂ equivalent). The annual totals for the NPRI and GHG from 2002 to 2008 were summarised for these sources; details of the relevant calculations can be found in the BHP Billiton EKATI Annual Reports, that are available online (<http://www.ec.gc.ca/pdb/npri/> and http://www.ghgregregistries.ca/challenge/index_e.cfm). For further information on the EKATI GHG Strategy and relevant calculation methods also refer BHP Billiton Greenhouse Gas Management Plan (ENVR-SWP-GHG-01, see Appendix 1).

2.3 HIGH VOLUME AIR SAMPLING (HVAS)

Ambient concentrations of Total Suspended Particulate (TSP) matter at EKATI have been collected seasonally (summer) since 1997 using the high volume air sampler (HVAS) method outlined in BHPB's Standard Operating Procedure (ENVR-SOP-AIR-01; see Appendix 2). The samplers (Graseby Model Gs2310, Series HVAS) pull large volumes of air (1,130 litres per minute or 40 cubic feet per minute) through a filter that collects TSP. TSP is a relatively coarse sized fraction. While the capture characteristics of the HVAS are dependent on the approach wind velocity, the effective D50 (i.e., the diameter where 50% of the particles are captured and 50% are not) varies roughly from 25 to 50 µm (U.S. EPA, 1991). The samplers, which are run on a six-day schedule, draw ambient air through the filter for a 24-hr period. Filters are weighed pre- and post-sampling to determine the mass of TSP. The filters are composed of binderless glass fibres and measure 20 by 25.4 cm - Graseby Model # G810. The HVAS are generally operated from June through September. The samplers are not operated through the winter because the electric motors that draw the air through the filter do not function properly under the extreme winter conditions. Although the HVAS units are designed to operate in extreme winter conditions, the 2006 review of the sampling program raised some concerns regarding the data quality collected during winter and the probability of introducing uncertainty to the value of data collected using HVAS. Hence, it was decided that sampling using HVAS during winter would not take place. TSP data during winter can be supplemented by the Continuous Air Monitoring program described in Section 2.4.

HVAS station TSP-1 was decommissioned prior to 2006. HVAS station TSP-2, located on the roof of the pump house at Grizzly Lake has operated annually since 1997, and continued to operate from 2007 to 2008. The HVAS station as TSP-2 was out of commission during 2006 while the AQMP was undergoing review and redesign, and was replaced with a new HVAS unit in 2007.

A new station (TSP-3) was installed at the base of a 30 m meteorological station approximately 500 m east of LLCF Cell B (Figure 2.3-1). The TSP-3 monitoring station commenced collecting data for the 2007 monitoring season and continued for the 2008 season.

The HVAS units were located downwind of EKATI camp, based on the wind direction results discussed in Section 3.1. Due to the annual predominant easterly wind direction, each sampling station was placed west of the main source to capture the easterly wind. TSP-3 was sited downwind of the main camp area and Fox and Sable Haul roads sited on the westerly side of the haul roads downwind of its emissions sources.

The quality assurance and quality control (QA/QC) procedures for HVAS relate to instrument calibration, sampling methodology and laboratory procedures for determining TSP. Details on the QA/QC procedures can be found in Appendix 2.

2.4 CONTINUOUS AIR MONITORING (CAM) BUILDING

A Continuous Air Monitoring (CAM) building was installed at Grizzly Lake in May 2007. The data recorded is used to prepare submissions to the Environment Canada's National Pollutant Release Inventory and Greenhouse Gas reports and for the purpose of the 2008 EKATI Annual and AQMP reporting. The equipment is housed in a building approximately 3 x 3 m and analyzers have been installed to continuously measure concentrations of sulphur dioxide (SO₂), oxides of nitrogen (NO_x), Total Suspended Particulate (TSP), and fine particulate matter (PM_{2.5}) as well as ambient outdoor temperature (Plate 2.4-1). Data is recorded using a data acquisition system on a computer in the building. Data is manually retrieved by BHP Billiton Environment staff on a monthly basis. The main benefit of the continuous data set is to complement emission calculations that were previously based on fuel consumption alone.



Plate 2.4-1. Continuous Air Monitoring Station at Polar Explosives, 2008.

The CAM building was initially installed approximately 200 m west of the existing HVAS at TSP-2, a location which was selected based on the presence of a power supply and a secondary generator to act as a back-up during any grid interruptions, as well as providing continuity of data from the TSP-2 site, which has been operating since the inception of the mine.

Following discussions with EC, GNWT and the IEMA in March 2008, the station was relocated in September 2008 to the Polar Explosives site (Figure 2.3-1). Twelve potential sites were evaluated and ranked for suitability. Consensus led to this site based on its central location at the mine site, predominantly downwind of generators and the majority of mine site sources.

The sampling and analytical technologies are sophisticated, sensitive to extreme temperatures and challenging to operate in the Arctic. To our knowledge, there are only three other such stations operating in the north, all operated by GNWT with a dedicated service engineer. To ensure the collection of quality data, a contract service technician, specialising in air quality monitoring equipment, was contracted in 2007 to assist in regular calibrations, troubleshooting and maintenance.

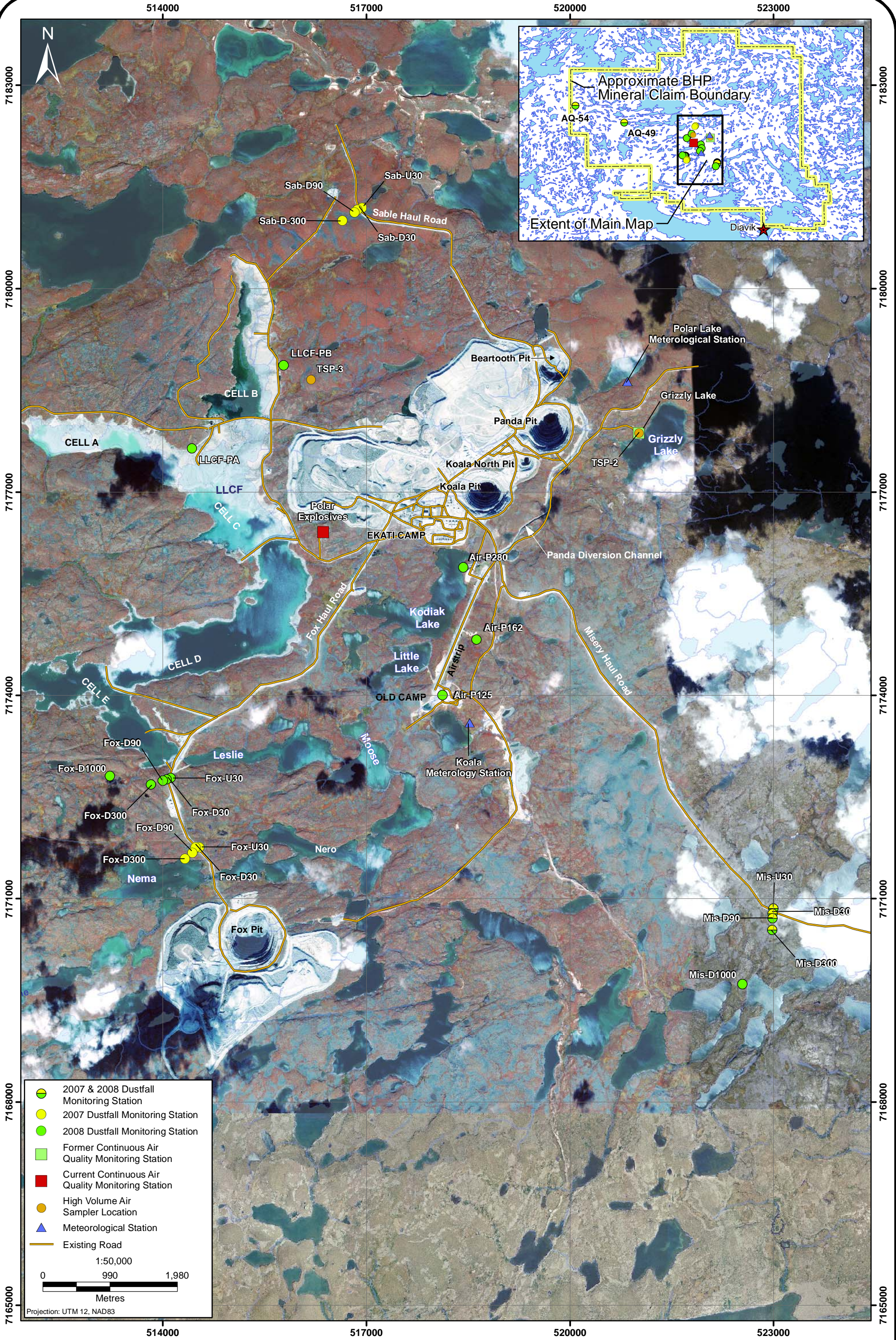
Since the installation of the CAM building in May 2007 multiple set-up phases and calibrations were performed on the continuous air monitoring equipment to ensure that it was in proper working order for commencement of monitoring in 2008. Data from January through August 2008 was collected at the Grizzly Lake location. The station was not operational from August 21 until October 3, as this time was required for moving the building, set up and calibration. Data recorded after October 3, 2008 was collected at the new Polar Explosives site.

2.5 DUSTFALL MONITORING

In July 2006, BHP Billiton established 14 dustfall monitoring stations at sites around EKATI to supplement the existing air quality monitoring program. Two of the dustfall stations served as background sites and were established at AQMP sites AQ-49 and AQ-54 approximately 21.5 km and 36 km west of the mine, respectively (these sites coincide with the snow and lichen collection sites for comparison purposes) (Figure 2.3-1). The remaining 12 stations were established in groups of four near the Fox, Misery and Sable Roads. One station was established approximately 30 m from the road centreline on the predominant upwind (northwest) side of the road; the other three stations were established on the predominant downwind side (southeast) at 30 m, 90 m and 300 m from the road centreline. These dustfall stations were used to monitor the deposition patterns for fugitive dust.

Stations AQ-49 and AQ-54 were located based on the results of the EKATI CALPUFF modelling published in 2006 (Rescan 2006) and described in Section 3.2. The CALPUFF modelling results for dust deposition determined that the zone of influence for fugitive dusts was 14 to 20 km from the mine. Sampling outside of this zone would provide results expected to be indistinguishable from background. Locating AQ-49 and AQ-54 21.5 km and 36 km, respectively, from mine sources (taken into account predominant winds) should provide representative data collection of background conditions.

During the initial year of monitoring in 2006, samples were collected during August and September. In 2007 sampling was extended to a three month period between July and September and in 2008 between June and August.



Dustfall and Air Quality Monitoring Stations for the 2008 AQMP

FIGURE 2.3-1

In 2008, following consultations with IEMA, EC EPD and GNWT RWED EPS, the dustfall monitoring plan was re-assessed. The Sable Road monitoring stations were discontinued due to inactivity along this road. At the Fox and Misery haul roads additional dustfall monitors were installed to capture dustfall concentrations 1000 m predominantly downwind of the road centerline. In order to incorporate the 1000 m station, while maintaining a straight transect, the location of the other dust monitors at Fox haul road had to be adjusted. These additional stations located 1000 m downwind from the haul road centreline were in response to the 1995 EIS predicting a settling of dust from road sources within 1 km of the road. Further, in 2008 an additional five dustfall monitoring locations were installed at (Figure 2.3-1):

The LLCF Containment Facility:

- LLCF-PA; and
- LLCF-PB.

The Air Strip:

- Air-P280;
- Air-P162; and
- Air-P125.

The dustfall monitoring stations (Figure 2.3-1) were constructed and sited in accordance with the methods outlined in ASTM D1739-98 (re-approved 2004) Standard Test Method for Collection and Measurement of Dustfall (Settleable Particle Matter). The stations consist of a canister containing a collection of medium (deionised water with algicide) that is exposed to the ambient air for a period of approximately 30 days. Each station contains two canisters, one for the particulate, sulphate and nitrate analysis and one for the total metal analysis. The dustfall samples were sent to ALS Environmental Laboratory (ALS) in Vancouver and processed according to the methods outlined in the 2005 BC Environmental Laboratory Manual Section G Air Constituents - Inorganic (BC MOE, 2005). Monitoring in 2006 was completed only for the months of July and August. Monitoring in 2007 and 2008 also included June.

Samples were analysed for soluble and insoluble particulate ($\text{mg}/\text{dm}^2/\text{d}$), sulphate, nitrate and total metals. There are no specific guidelines for fugitive dust deposition in the Northwest Territories; however, the 1979 British Columbia Pollution Objective for the Mining, Smelting and Related Industries for total particulate (sum of soluble and insoluble particulate) is 1.7 to 2.9 $\text{mg}/\text{dm}^2/\text{d}$ as a 30 day average. This British Columbia dustfall objective is similar or slightly more stringent than other Canadian jurisdictions and has been used for comparison to the monitoring results.

2.6 SNOW CORE SAMPLING

2.6.1 Field Methods

The snow sampling program was revised in 2008 in consultation with EC, GNWT and IEMA, which was based on a review of the 2005 sampling program. The revised program defined 33 snow core sampling sites in a generally radial pattern away from the mine site, to measure change with distance from the mine site (Figure 2.6-1).

Snow samples were collected between April 9 and April 21, 2008. Duplicate samples were collected for quality assurance and quality control purposes (QA/QC) at three of the 33 sites. The sampling locations represent a variety of terrain types and distances from mine operations. Sloping sites were selected so

that adequate snow accumulation was present, with the slope facing toward the mine site to avoid sheltering from the monitored source. At each site, three separate snow samples were collected using a Mt. Rose sampler from the upper, middle and lower slope positions (Plate 2.6-1). Snow depth and core mass were measured for each sample to allow calculation of the snow water equivalent (SWE). The three samples were then homogenised and shipped to ALS, Vancouver, in pre cleaned sample containers supplied by the lab. The snow chemistry parameters (Table 2.6-1) are the same as those used in the Aquatics Effects Monitoring Program (AEMP) for water quality.



Plate 2.6-1. Mt. Rose snow core sampler.

2.6.2 Data Analysis

For calculation purposes, concentrations that were below the detection limit were assigned a value of half the detection limit. Due to spatial and inter-annual variability in snow pack depth, raw concentration (mg/L) values were not used to analyse snow samples; a sample taken in a deep snow pack will produce lower results than a sample from a shallow snow pack.

In order to compare samples spatially and temporally, the surface loading rate (mg/m²/day) was calculated by multiplying the parameter concentration (mg/L) by the volume of snow-water-equivalent (L) and dividing by the surface area (m²) of the snow core, and the length (days) of the snow season. It was assumed that the snow season began on October 15, 2007. Snow sampling occurred between April 9 and 21, 2008, therefore the length of the snow season for each sample ranged between 191 and 203 days.

To analyse the data spatially, the distance from each sampling site to the nearest centre of activity was calculated, similar to the 2005 AQMP. The majority of activity occurs in the area around the Main Camp, which also includes the Processing Plant, Panda/Koala underground and Beartooth pit, and their associated waste rock storage areas. Additionally, between 2006 and 2008 the Misery Pit and the Fox Pit in particular, were centres of significant activity. However, as snow sampling occurred in 2008 and the Misery site was effectively inactive in 2008 compared to previous years, this site was excluded as a centre of activity for analysis purposes. As such, spatial patterns in snow chemistry data were analysed based on the distance from the sampling site to the nearest centre of activity (Main Camp or Fox Pit).



Table 2.6-1. Water Quality Parameters for Snow Core Samples

Parameters	Units	Parameters	Units
Physical/Ion Parameters		Total Metals	
Alkalinity, Total	mg/L	Aluminum (Al)	mg/L
Bicarbonate (HCO ₃)	mg/L	Antimony (Sb)	mg/L
Carbonate (CO ₃)	mg/L	Arsenic (As)	mg/L
Conductivity (EC)	µS/cm	Barium (Ba)	mg/L
Hydroxide	mg/L	Beryllium (Be)	mg/L
pH	log units	Boron (B)	mg/L
Chloride (Cl)	mg/L	Cadmium (Cd)	mg/L
Potassium (K)	mg/L	Calcium (Ca)	mg/L
Silicon (Si)-Total	mg/L	Chromium (Cr)	mg/L
Sulphate (SO ₄)	mg/L	Cobalt (Co)	mg/L
Total Suspended Solids	mg/L	Copper (Cu)	mg/L
Turbidity	NTU	Iron (Fe)	mg/L
Hardness	mg/L	Lead (Pb)	mg/L
Ion Balance	%	Magnesium (Mg)	mg/L
TDS (calculated)	mg/L	Manganese (Mn)	mg/L
Nutrients/Organics		Mercury (Hg)	mg/L
Total Ammonia-N	mg/L	Molybdenum (Mo)	mg/L
Nitrate-N	mg/L	Nickel (Ni)	mg/L
Nitrite-N	mg/L	Selenium (Se)	mg/L
Orthophosphate (PO ₄ -P)	mg/L	Silver (Ag)	mg/L
Total Phosphorus	mg/L	Sodium (Na)	mg/L
Total Organic Carbon	mg/L	Strontium (Sr)	mg/L
Total Kjeldahl Nitrogen	mg/L	Uranium (U)	mg/L
		Vanadium (V)	mg/L
		Zinc (Zn)	mg/L

2.7 LICHEN TISSUE SAMPLING

Lichens are well known for being good indicators of air quality and are commonly used as monitors for metal accumulation (Markert, 1993; Tyler, 1989). They are suitable biomonitors due to their wide geographical distribution, their availability for collection throughout the year and their stable morphology (little seasonal variability) (Markert, 1993). Precipitation is a primary source of mineral nutrition and metals in many lichens (Tyler, 1989). Lichens are also used as pollution monitors because they concentrate a variety of pollutants in their tissues. They often accumulate sulphur, nitrogen and metals from atmospheric sources better than vascular plants and can accumulate pollutants quickly (Blett et al., 2003). Measurable changes in tissue concentrations of macronutrients such as nitrogen, sulphur, potassium, magnesium and calcium can occur over weeks or months. Seasonal changes in deposition of tissue macronutrients also occur because the macronutrients are mobile and easily leached (Blett et al., 2003). Therefore, those that have an ability to accumulate metals without any obvious adverse effects are the best lichens to use for metals monitoring.

Detailed methodology describing field sampling, laboratory and data analysis are described in Appendix 3. A summary is provided below.

2.7.1 Field Methods

Lichen sampling for metals analysis is carried out every three years in conjunction with snow core sampling. In previous reports data limitations (including small sample size and lack of detailed lichen tissue data in 1998) prevented the analysis of change in lichen tissue concentrations over time. Given improvements to the sampling methods in 2005 and 2008, as the program moves forward, this limitation will cease to exist.

A total of 37 lichen plots were sampled for lichens between August 9 and 12, 2008 to indicate dust dispersion from EKATI. Most were accessed by helicopter, two were accessed by road. Most sample areas were within 100 m of the 2005 sample locations and likely overlapped the 2005 locations in space. Five of the sites were included to cover gaps in the sample area to the north and south of the mine site. The lichen plots have a tendency to be more concentrated close to the mine site, but the sample area covers a large area approximately 70 km (west to east) by 40 km (south to north) with the mine site located near the centre of this oblong area, and to the south east. Figure 2.6-1 shows the location of the lichen plots.

In each lichen biomonitoring plot, lichens (*Peltigera rufescens* and *Flavocetraria cucullata*) were sampled into two bags for each of the three personnel collecting in the field (K. Enns, S. Ban and C. Blechert) using the methods described in Bargagli and Nimis (2002) where a species can be composited from three similar substrates in the field then split into replicates out of the field to include variance in concentrations within a lichen location. Neither samples, nor species were mixed between lichen site locations. Lichen thalli (the equivalent of leaves and stems) were separated from their substrate by hand, using latex gloves, and placed in labeled paper bags. Gloves were changed between lichen plots. The upright foliose lichen *F. cucullata* was collected in all of the 37 lichen plots, and *P. rufescens* was collected in 27 of the 37 lichen plots, as it was not as common as *F. cucullata*. The rationale for the use of *Flavocetraria cucullata* and *Peltigera rufescens* is as follows:

1. *Flavocetraria cucullata* was previously sampled by Rescan in 2005 and was re-sampled in 2008 to provide continuity. There are differences in uptake ability in different genera of lichens (Bargagli and Nimis, 2002) and it is not advised to compare between different genera over time;
2. *Flavocetraria cucullata* also has been used in arctic elemental uptake studies in the past and its mode of accumulation of dust is reasonably well understood and documented (Walker et al. 2003);
3. *Flavocetraria cucullata* is common throughout the Northwest Territories and relatively abundant, which is important to sustain a long term biomonitoring program;
4. *Flavocetraria cucullata* is known to be widely consumed by caribou and is an indicator or dietary uptake of toxic substances; and
5. *Peltigera rufescens* was also used in 2008. Species of *Peltigera* actively take up depositional particulate especially sulphur and nitrogenous compounds (i.e., they are slightly accumulative in comparison to *F. cucullata*). They are better documented in the world wide literature (Fritz Sheridan, 1985; Hallingback. and Kellner, 1992).

Replicates were split from the samples, to show the variance in absorption of dust. Average concentrations for each of the two species represent the composited sample for each lichen monitoring plot.

The lichens were refrigerated between collection and the drying and sorting lab, where they were cleaned of plant debris and holdfast tissues. They were not washed. The samples were laid out to dry at 16°C for two weeks and were frequently turned until they no longer changed weight (i.e., dry). The samples were then ground in a coffee mill used only for lichen sample processing. Between samples, the mill was

cleaned with dry tissue, followed by alcohol, and then wiped dry with clean dry tissue a second time. The samples were shipped in a single cooler with a cold pack to ALS Vancouver in December of 2008.

Some of the subsamples have been archived for cross referencing or QA/QC, if required. Spiked samples of the same species are also available for comparison. Spiked samples are those that have a measured and therefore known exposure to an element. These samples are used to measure the accuracy of determination of the field sample.

During field sampling of lichen tissue observations were taken at each site to record the presence of dust deposition and potential smothering of vegetation.

Sample analysis methods are described in more detail in Appendix 3 and consisted of ICP-MS (Inductively Coupled Plasma Analysis Mass Spectrophotometry) with the lowest detection limits possible.

2.7.2 Data Analysis

Trends in the lichen data were compared to the previous samples (Rescan, 2006), and to values in the literature (Bargagli and Mikhailova, 2002; Nieboer et al. 1978; Rhodes, 1999; Nash and Gries, 1995). Variations in elemental concentrations at sites with multiple samples were compared to sites where only one sample was collected. It should be noted that multiple samples were collected where possible; some areas are very lichen-poor as caribou use of this forage plant is heavy throughout the study area. *P. rufescens* absorption is well referenced in the literature, therefore, comparisons were made to the literature using mainly this species, but *F. cucullata* was also compared where applicable.

The gradation of concentration versus distance from the mine site of the metals chromium, magnesium, vanadium and nickel was plotted as a preliminary indication of dust behaviour, as these elements appeared to show the strongest relationship with distance in the 2005 AQMP report. Concentrations were also plotted as low, medium and high concentrations to show spatial relationships with the mine site and with roads.

Statistical analyses were conducted to answer the following questions:

1. Is there a difference in element concentrations in co-located *F. cucullata* between 2005 and 2008?
2. Is there a relationship between dustfall measurements (maximums) and the concentration of elements in *F. cucullata*?
3. Is there a relationship between metal concentrations in snow water measurements (maximums) and the concentration of elements in *Flavocetraria cucullata*?

The statistical means to test the significance of the above relationships are described in Section 3 of Appendix 5.

3. Results and Discussion

3. Results and Discussion

3.1 EKATI METEOROLOGY

3.1.1 Temperature

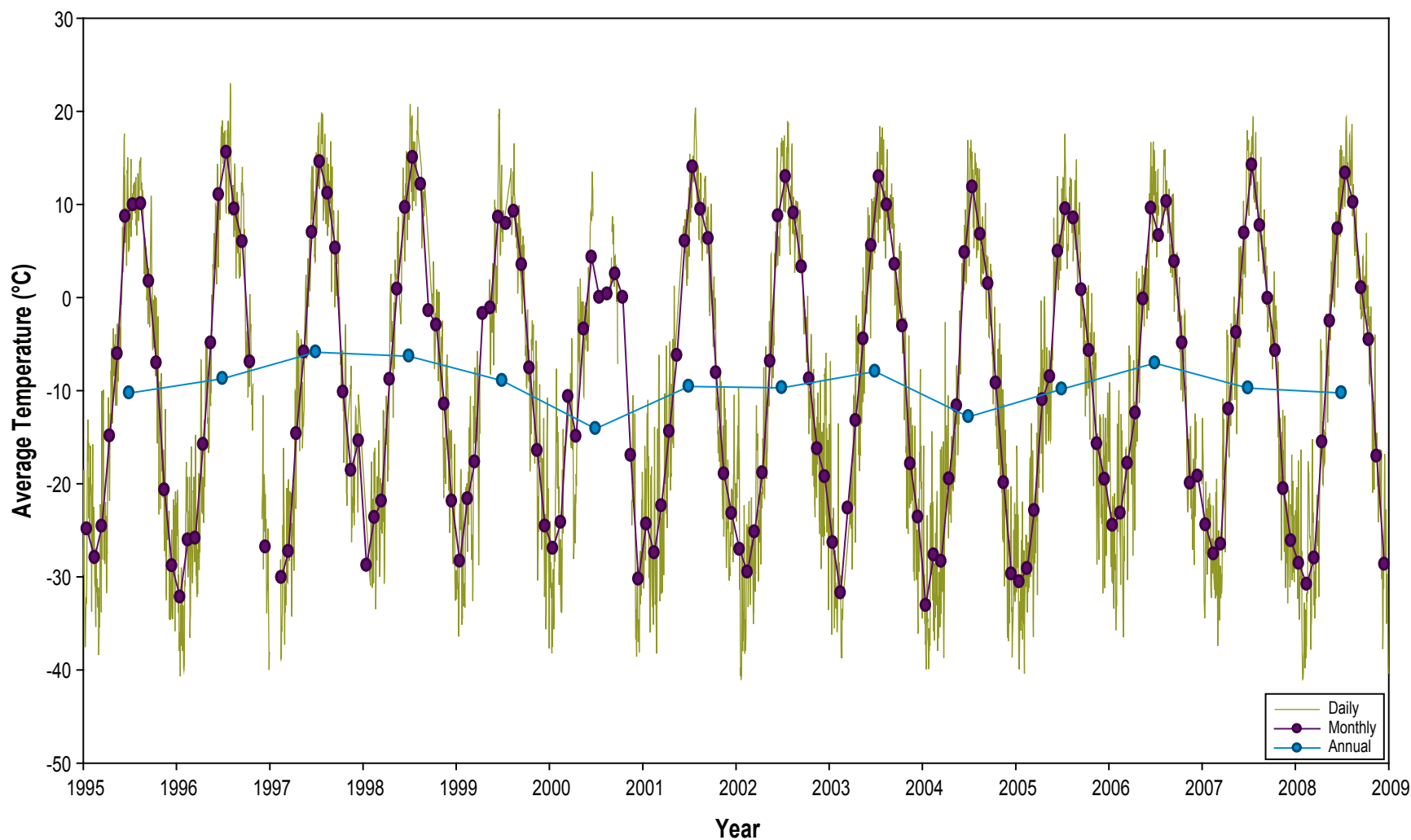
Monitoring temperature is an important component of the air quality monitoring program. Day-to-day ambient temperatures control the rate of chemical reactions that generate or transform a number of secondary air pollutants (e.g., O₃, NO_x) as well as thermal advection. Long-term temperature trends reflect emissions of greenhouse gases and particulates. As has been widely reported (e.g., IPCC, 2007), arctic regions are particularly sensitive to global climate change. While global climate change has focussed mainly on greenhouse gas emissions, recent research suggests that long-range transport of aerosols (fine particulates, particularly black carbon) may also be driving a significant portion of the observed Arctic warming (Shindell and Faluvegi, 2009).

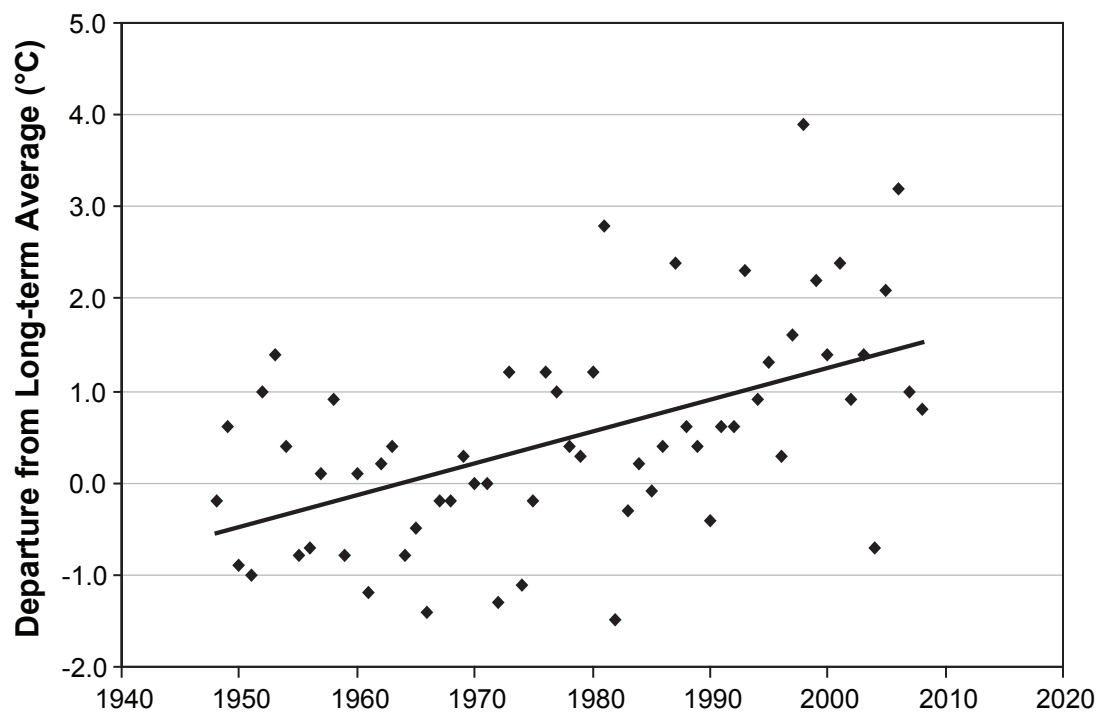
Figure 3.1-1 shows average temperature from the Koala meteorology station at the daily, monthly and annual time scales. Clear seasonal trends are evident: daily temperatures generally rise above 0°C in early June, marking the start of the open-water season; summer maximums generally reach 20°C; by early October daily temperatures drop below 0°C, marking the end of the open water season and the start of winter; winter minimums commonly reach -40°C.

Table 3.1-1 ranks annual temperatures for EKATI and the Mackenzie District Climate Region (MSC, 2009). Results are presented as departure from the long-term average. The two data sets have different lengths of record; however, there is agreement that years 1998 and 2006 were especially warm years, while 2004 was an especially cold year. Figure 3.1-2 summarizes the long-term warming trend for the Mackenzie District. While it is expected that similar warming has occurred at EKATI, it is not currently evident in the comparatively short data record.

Table 3.1-1. Ranking of Average Annual Temperature (Based on Departure from Average) for EKATI and the Mackenzie District Climate Region

EKATI			Mackenzie District		
Rank	Year	Departure (°C)	Rank	Year	Departure (°C)
1/14	1997	3.5	1/61	1998	3.9
2/14	1998	3.1	2/61	2006	3.2
3/14	2006	2.3	5/61	2001	2.4
4/14	2003	1.4	7/61	1999	2.2
5/14	1996	0.6	8/61	2005	2.1
6/14	1999	0.4	9/61	1997	1.6
7/14	2001	-0.2	10/61	2003	1.4
8/14	2002	-0.3	12/61	2000	1.4
9/14	2007	-0.4	13/61	1995	1.3
10/14	2005	-0.5	18/61	2007	1.0
11/14	2008	-0.9	21/61	2002	0.9
12/14	1995	-0.9	23/61	2008	0.8
13/14	2004	-3.5	35/61	1996	0.3
14/14	2000	-4.7	50/61	2004	-0.7





3.1.2 Precipitation

Precipitation data are presented based on water year (October 1 to September 30) in Table 3.1-2. Total precipitation is a combination of snowfall (measured as snow-water-equivalent) and rainfall. Snow-water-equivalent is measured with a Nipher Snow Gauge located adjacent to the Koala meteorology station, as well as through snow core samples collected across the claim block in late winter. Rainfall is measured at the Koala station with a tipping bucket rain gauge.

Table 3.1-2. Summary of Annual Precipitation at EKATI

Year	Total Precipitation (mm)	Snowfall (%)
1994	280	n/a
1995	519	n/a
1996	510	n/a
1997	n/a	n/a
1998	371	61
1999	458	43
2000	272	48
2001	336	57
2002	321	24
2003	288	59
2004	222	35
2005	248	39
2006	426	35
2007	257	54
2008	422	22

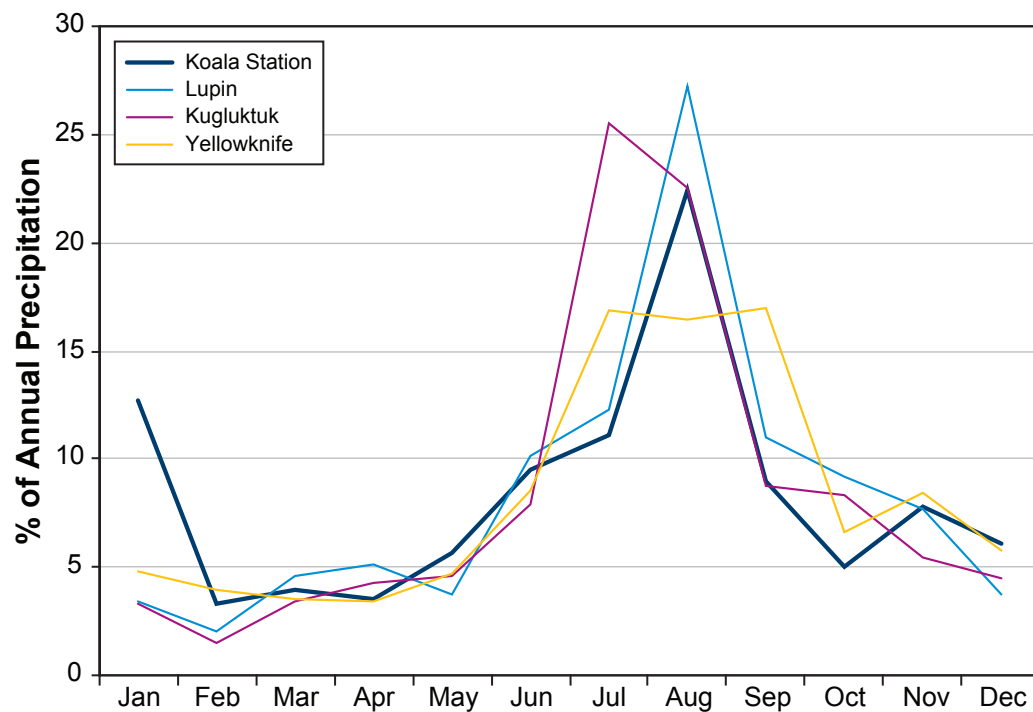
In general, the Arctic climate at EKATI is characterized by stable arctic air masses that produce relatively low annual precipitation. Figure 3.1-3 summarizes the monthly precipitation distribution. Winter accumulation generally accounts for 40 to 50% of the total precipitation, while August generally records the highest single monthly total.

3.1.3 Wind Speed and Direction

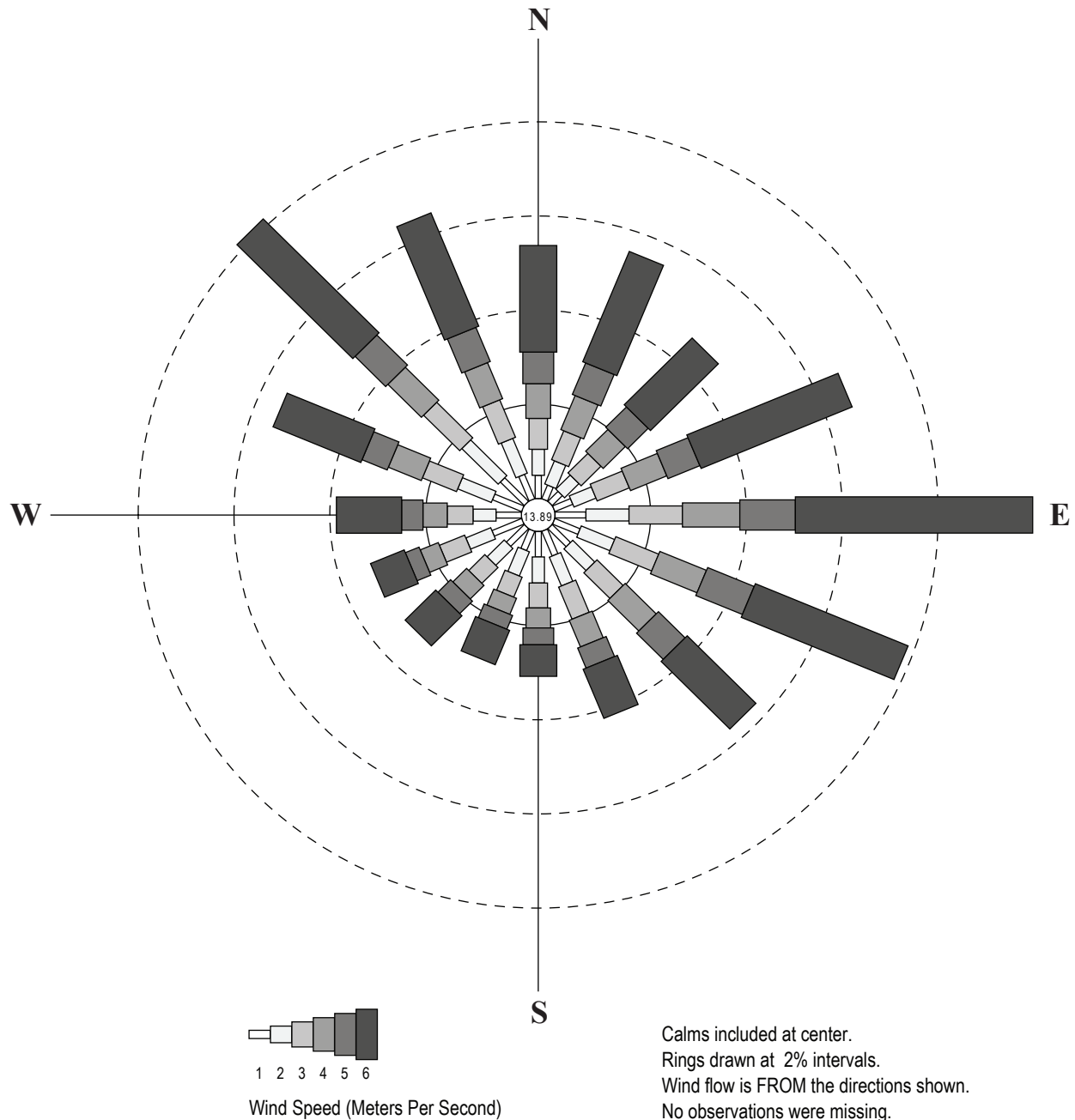
Wind speed and direction data are important for assessing how air emissions from the mine will be distributed to the surrounding regional and local area. Long-term wind data from the Koala station are summarized in Figure 3.1-4. The Figure indicates that the EKATI area is fairly windy, with the most common wind speeds exceeding 6 m/s (~20 km/h). Winds at the site are omni-directional, however there is a primary component from the east (24% coming from the ENE, E and ESE), and a secondary component from the northwest (19% from the WNW, NW, and NNW).

3.2 2006 CALPUFF AIR DISPERSION MODELLING SUMMARY

A CALPUFF modelling exercise was completed in 2005 and a report detailing the result of the air dispersion modelling was finalized in 2006 (Rescan, 2006). Limited comparison was made to the predictions of the air dispersion model in the 2005 AQMP because the model results at the time were preliminary. The results of the 2008 AQMP presented in this report are therefore reviewed in the context of the 2006 CALPUFF modelling results. A summary of the findings of the EKATI CALPUFF air dispersion modelling report (Rescan, 2006) are described below.



Note: based on data from 2001 to 2008

Koala Meteorological Station

Model predictions of ambient SO₂ and NO₂ concentrations showed that Northwest Territories Ambient Air Quality Standards (Table 3.2-1) and CAAQO (Table 3.2-2) were predicted to be met outside of the active mining area when using the Ozone Limiting Method (OLM) for estimating the NO to NO₂ conversion rate. The active mining area was defined as any footprint area that is subject to or associated with various mining activities (e.g., active open pits, haul roads, plant site and processed kimberlite contaminant areas). Ambient concentrations of SO₂ and NO₂ were predicted to be well below applicable standards outside the EKATI claim block.

Table 3.2-1. Northwest Territories Ambient Air Quality Standards

Air Contaminant	Average Period	Standards (µg/m ³) ¹	Standard (ppb) ²
Sulphur Dioxide	1-hour	450	172
	24-hour	150	57
	Annual	30	11
Ground Level Ozone	8-hour	127	65
Total Suspended Particulate	24-hour	120	
	Annual	60	
Fine Particulate (PM _{2.5})	24-hour	30	n/a

NA = Not Available.

¹: Micrograms per cubic metre.

²: Parts per billion by volume.

Table 3.2-2. Summary of Canadian Ambient Air Quality Objectives

Parameter	Unit	Maximum Desirable Concentration (1 Hour)	Maximum Acceptable Concentration (24 Hour)	Maximum Tolerable Concentration			
				1 Hour	24 Hour	1 Hour	24 Hour
Sulphur Dioxide	µg/m ³ (ppb)	450 (172)	150 (57)	900 (344)	300 (114)	-	800 (306)
Nitrogen dioxide	µg/m ³ (ppb)	-	-	400 (213)	200 (106)	1000 (532)	300 (160)
Nitrogen Oxide	µg/m ³ (ppb)	-	-	-	-	-	-
Nitrogen Oxides	µg/m ³ (ppb)	-	-	-	-	-	-
Total Suspended Particulate	µg/m ³	-	-	-	120	-	400
Fine Particulate (PM _{2.5})	µg/m ³	-	-	-	30	-	-

1: Canada-wide Standards established in 2000. Based on annual 98th percentile value.

Model predictions of 24-hour PM_{2.5} concentrations exceeded NWT guidelines of 30 µg/m³ within a corridor along the Misery haul road and the active mining areas. The corridor was defined in the dispersion model to represent the haul roads between EKATI main camp and misery. In addition, model concentrations of 24-hour TSP and annual average TSP exceeded NWT guidelines within this corridor. The model predicted that standards for ambient PM_{2.5} and TSP concentrations were met everywhere outside the EKATI claim block.

The model results showed that the Potential Acid Input (PAI) loads were less than 0.25 keq/ha/yr at a distance of 2.5 to 3.0 km from the centre of EKATI mine or effectively within the active mine area. PAI quantifies the theoretical maximum possible acid deposition input rather than the most likely acid deposition input. A PAI load of 0.25 keq/ha/yr is the current standard for highly sensitive soils adopted by the Government of Alberta. The Government of Northwest Territories does not currently have critical load standards.

Model predictions for nitrate deposition were not conclusive due to uncertainties associated with chemical reaction rates of NO_x conversion to nitrate. However, model predictions of potential (maximum) nitrate deposition rates show that contributions of mining operations to nitrate deposition are negligible beyond 5 to 10 km from the mine areas. In addition, snow core chemistry and lichen data do not show a decreasing trend of nitrate deposition with increasing distance from mining activities (see Sections 3.6 and 3.7). If the mining activities at EKATI resulted in significant local nitrate deposition, a trend of decreasing nitrate loadings with distance from the mine should have been evident in these analysis results. Results also indicate a strong correspondence between the CALPUFF model results and the regressions of water pH versus nitrogen and sulphur dioxide derivatives. The significance of this correlation is discussed further in Section 3.7.6.

The predicted TSP deposition contours (isopleths) show a steep gradient of TSP deposition close to the sources and the deposition of TSP resulting from mine fugitive dust emissions was indistinguishable from background deposition rates at a distance of 14 to 20 km from the active mining areas. This finding is consistent with the findings from the 2005 AQMP report, as well as the 2008 AQMP results described in subsequent sections of this report.

3.3 AIR AND GREENHOUSE GAS EMISSIONS

At EKATI, the combustion of diesel for power generation and heating buildings, mobile equipment operating around the site, and blasting are the main sources of greenhouse gases. Secondary sources of greenhouse gas emissions are the combustion of used oil for heating buildings and the combustion of Jet A1 fuel by helicopters and small aircraft working around the claim block. It should be noted that in order to remain consistent with BHP's GHG Management Plan, all reported fuel usage and emission estimates presented in this section are based on fiscal (July 1st- June 30th) year data.

Consumption of fuel at EKATI has continued to be less than that observed between 1998 and 2006. This is partly due to the inception of the Energy Smart Program (initiated in 2002, as site wide initiative to reduce greenhouse gas emissions), and as a result of the evolution of the mine plan, with underground mining now replacing some of the open pit mining. Fuel consumption at EKATI between 2006 and 2008 is presented in Table 3.3-1. In comparison to 2006 fuel consumption, there was 7% less diesel used in 2008, mainly in the areas of motive diesel. A detailed comparison of diesel use showed decreases in fuel use for blasting, and motive use (e.g., vehicles). Increases in diesel use were noted in the categories of non-motive (e.g., generators, light plants), heating and power generation. Significant effort is undertaken at EKATI to reduce emissions and fuel use on the mine site each year.

Table 3.3-1. Annual Fuel Consumption at EKATI, 2006 to 2008

Year	Diesel Other Non-Motive (L)	Diesel Motive (L)	Diesel Heating (L)	Diesel Power (L)	Diesel Total (L)	Aviation Jet A-1 (L)	Waste Oil (L)
2006	2,307,437	36,608,693	6,871,329	29,190,462	74,977,921	84,783	584,099
2007	1,770,963	26,831,180	7,384,674	31,371,141	67,357,958	87,460	780,642
2008	4,231,576	20,542,405	11,179,178	33,779,585	69,732,744	70,824	370,395

Note: Fuel consumption data is reported per calendar year.

Source: EKATI GHG Master Spreadsheet Version 5 (Jamie Steele)

A 'No Idle' campaign was implemented in 2006 to 2008, a site wide policy that prohibits users from idling light vehicles when stopped for extended periods of time - such as when parked for lunch. An onsite shuttle service has contributed to the success of this program by decreasing the need for each business unit to have vehicles, as has the enforcement of this policy and the rewarding of drivers of vehicles observed not idling.

As the mine transitions from open pit to underground mining operations, additional reductions in diesel motive consumption are being realized with surface mobile equipment being decommissioned and shipped off site.

As a result of these two factors, there was a reduction in use of mobile diesel of 6,228,278 litres (23%) between 2007 and 2008 and a 44% reduction between 2006 and 2008.

In a similar ongoing program, 370,395 litres of waste oil were burned on site in 2008 to heat air for underground workings. The benefits of use of this oil on site were less diesel burned to heat underground air, and no diesel burned in the transportation of this oil to a southern location as waste.

The noted increases in fuel used for heating and power in 2008 are attributable to a colder winter than previous years, and the construction of the Cell B west discharge line during the winter, which required mobile heaters to facilitate line construction.

As indicated above, the reduction in fuel consumption relates to reduction in greenhouse gas emissions at EKATI. A total of 195,174 tonnes of greenhouse gas emissions were calculated to be released as CO₂ equivalencies in 2008 (Table 3.3-2). The 2008 calculated CO₂ equivalency was marginally higher than for 2007 (Table 3.3-3). The average annual greenhouse gas emissions from 2006 to 2008 were 198,899 tonnes of CO₂ equivalent. This is 20% less than that estimated during 2003 to 2005 (248,245 tonnes of CO₂ equivalent).

Table 3.3-2. Summary of Monthly Fuel Consumption and Greenhouse Gas Emissions for 2008

Month	Total Fuel ¹ (L)	CO ₂	CH ₄	N ₂ O	Total GHG Emissions ² (tCO ₂ e)
July 07	4,540,872	12,518	11	116	12,645
August 07	4,717,557	13,005	12	121	13,137
September 07	4,696,832	12,940	12	120	13,072
October 07	5,773,781	15,942	14	147	16,103
November 07	6,344,274	17,445	16	161	17,623
December 07	6,620,352	18,191	17	168	18,376
January 08	7,588,616	20,852	19	193	21,064
February 08	6,918,828	19,027	17	176	19,220
March 08	7,061,710	19,412	18	179	19,609
April 08	6,289,030	17,367	16	159	17,542
May 08	5,256,485	14,491	13	133	14,638
June 08	4,365,626	12,022	11	111	12,144
Annual Total ³	70,173,963	193,213	176	1,786	195,174

¹: Total fuel is comprised of diesel, Jet-A-1 and waste oil.

²: Total GHG emissions also include emissions from blasting and fuel.

³: Totals may not add exactly due to rounding of values.

Source: EKATI GHG Master Spreadsheet Version 5 (Jamie Steele)

Table 3.3-3. Annual Summary of Fuel Consumption and Greenhouse Gas Emissions, 2006 to 2008

Year	Total Fuel ¹ (L)	CO ₂	CH ₄	N ₂ O	Total GHG Emissions (tCO ₂ e)
2006	75,646,803	209,207	190	1,924	211,322
2007	68,226,060	188,299	171	1,734	190,202
2008	70,173,963	193,213	176	1,786	195,174

1: Total fuel is comprised of diesel, Jet-A-1 and waste oil.

Note: data is reported per calendar year.

Source: EKATI GHG Master Spreadsheet Version 5 (Jamie Steele)

The greenhouse gas emissions for the entire Northwest Territories in 1996, immediately prior to the development of EKATI, were estimated to be 1.090 million tonnes of CO₂ equivalent. As of 2005, the Northwest Territories total emissions were approximately 1.750 million tonnes of CO₂ equivalent, a 61% increase over the period (GNWT, 2007). Thus, emissions at EKATI represent approximately 11% of the 2005 total Northwest Territories emissions. It should be noted that EKATI is one of the largest industrial development to date in the Northwest Territories and would be expected to contribute a significant portion of the overall greenhouse gas emissions. Total CO₂ emissions in Canada were estimated to be 721 million tonnes in 2006 (Environment Canada, 2006b) hence average annual EKATI emissions over 2006 to 2008 represent 0.03% of this total.

Initial results suggest air emissions reduction programs at EKATI have been effective and BHP Billiton continues to explore new ways to reduce diesel consumption and resulting emissions.

3.4 AMBIENT AIR MONITORING

3.4.1 High Volume Air Sampling

The Northwest Territories Ambient Air Quality Standard for 24 hr Total Suspended Particulate (TSP) concentration is 120 µg/m³ (Table 3.2-1). The GNWT standard is developed in line with the Canada wide National Ambient Air Quality Objectives and Guidelines (NAAQOs) for TSP (24-hour). This standard sets the bar for the long-term air quality protection of unpolluted areas in the country.

The high volume air sampler TSP-2 is located at Grizzly Lake on a deck above the fresh water pumphouse. The location of this unit has remained unchanged since its commissioning in 1999, although the sampler was replaced in 2007 with a new unit. During 2006, the sampler was out of commission, however, in 2007, 22 samples of TSP were collected and the average concentration was 4.90 µg/m³. In 2008, 30 samples were collected with an average concentration of 15.5 µg/m³ (Table 3.4-1). The arithmetic mean daily concentrations measured in 2007 and 2008 were less than the Government of Northwest Territories TSP daily maximum criteria of 120 µg/m³.

The arithmetic mean for 2007 at TSP-2 is similar to TSP-2 results for two (1999 and 2007) of the six previous years and TSP-2 data for 2008 is similar to TSP-2 results for three (2001, 2002 and 2003) of the six years over the 1999 to 2005 period, suggesting TSP-2 data over this monitoring review period are generally consistent with historical data (Table 3.4-1). However, the arithmetic mean TSP was considerably less in 2007 than that measured in 2008 and the program mean of 14.9 µg/m³ calculated at TSP-2 between 1999 and 2008.

Table 3.4-1. Summary of High Volume Sampling Data for 1994 to 2008

Year	Sample Station	Number of Samples	Maximum [TSP] 24 hour ($\mu\text{g}/\text{m}^3$)	Minimum [TSP] 24 hour ($\mu\text{g}/\text{m}^3$)	Arithmetic Mean ($\mu\text{g}/\text{m}^3$)	Geometric Mean [TSP] 24 hour ($\mu\text{g}/\text{m}^3$)	Number of Times Daily Maximums Exceeded
1994	TSP-1	30	320.00	4.00	57.20	30.40	4
	TSP-2	Not Established					
1997	TSP-1	16	37.60	2.60	15.70	11.40	0
	TSP-2	Not Established					
1998	TSP-1	17	137.90	1.90	50.00	28.10	2
	TSP-2	Not Established					
1999	TSP-1	15	117.00	2.60	40.40	21.90	0
	TSP-2	15	19.90	0.00	4.50	2.80	0
2000	TSP-1	23	205.90	5.00	69.00	40.00	5
	TSP-2	23	59.40	0.20	13.40	8.00	0
2001	TSP-1	23	561.40	7.30	93.50	55.70	5
	TSP-2	23	94.80	1.30	14.96	8.22	0
2002	TSP-1	21	294.30	8.70	87.10	49.50	5
	TSP-2	21	55.50	2.50	15.60	11.00	0
2003	TSP-1	Decommissioned					
	TSP-2	19	50.90	0.201	17.20 ^a	6.10 ^a	0
2004	TSP-1	Decommissioned					
	TSP-2	17 ^b	101.40	1.003	29.73	17.90 ^c	0
2005	TSP-1	Decommissioned					
	TSP-2	9	12.90	0.70	4.30	2.70	0
2006	TSP-1	Decommissioned					
	TSP-2	Out of Service					
2007	TSP-1	Decommissioned					
	TSP-2	22	15.50	0.30	4.90	3.10	0
	TSP-3	21	35.50	0.02	5.94	2.22	0
2008	TSP-1	Decommissioned					
	TSP-2	30	90.3	0.2	15.50 ^d	5.36	0
	TSP-3	30	267.5	0.1	36.60 ^e	9.75	2

^a: Two results were considered questionable as they had negative values. These results were not included in the calculation of the minimum value.

^b: High Volume Air Sampler failed on August 22, 2004 and was out of order for the remainder of the season. This sample was not included in calculations.

^c: One result was considered questionable as it had a negative value. This result was not included in the calculation of the minimum value or the geometric or arithmetic mean.

^d: Four values were excluded from the calculation of the minimum value or the geometric mean because they were negative.

^e: Three values were excluded from the calculation of the minimum value or the geometric mean because they were negative.

In 2007, a new sampling unit (TSP-3) was added to the program. TSP-3 was placed at a location referred to as "Cell B". The actual location is immediately east of Cell B of the LLCF approximately 100 m up a rise. The location of this unit was sited to be downwind of main camp area (based on the

predominant easterly wind direction shown in Figure 3.1-4), and close to an existing power source. Twenty-one samples were collected in 2007 at TSP-3 with an average daily TSP concentration of $5.94 \mu\text{g}/\text{m}^3$. In 2008, 30 samples were collected with an average concentration of $36.6 \mu\text{g}/\text{m}^3$. The maximum acceptable 24 hr (daily) concentration was exceeded on two occasions, July 19, 2008 ($259.4 \mu\text{g}/\text{m}^3$) and September 15, 2008 ($267.5 \mu\text{g}/\text{m}^3$). Following further reconciliation of field data sheets it was noted that on July 19th, 2008 there was noticeable smoke from forest fires in the air. On September 15th, 2008 the field data sheet noted the presence of excessive soiling, suggesting a high concentration of suspended particulates had been deposited. It is likely that these external sources contributed to a spike in total suspended solids and the isolated exceedances of the CAAQO daily objective at TSP-3 on these dates. Further review to EKATI records did not reveal additional mine related activities that could contribute to higher TSP concentrations.

A review of meteorological data was conducted for the two days showing exceedances in TSP at TSP-3 (July 19 and September 15, 2008). For July 19, 2008, hourly wind speeds ranged from 1.6 m/s to 10.5 m/s, and wind direction was from the S and SW. No precipitation was recorded for the few days prior to July 19, so dry, dusty conditions could be a potential cause for elevated TSP levels. On September 15, 2008 wind speeds ranged from 2.0 m/s to 7.6 m/s, wind direction was from the N and NE, and 1.8 mm precipitation was recorded on Sept 13, 2008. This review does not suggest a strong correlation between meteorological conditions and elevated TSP related to mine activities as the wind direction was not from the E or SE.

Annual average total suspended particulates at EKATI were not compared to annual national or territorial standards because the units are only operated between May and October. With the introduction of a second TSP sampler (TSP-3) in 2007 and CAM in 2008, valid long-term trends will become evident and will be incorporated into the analyses provided in future air quality monitoring program reports. The current data suggest EKATI mine operations produce suspended particulates, however, concentrations are generally within the guidelines and are considered to have a negligible effect on the local EKATI environment. These findings support the CALPUFF air dispersion modelling prediction that deposition of TSP resulting from mine fugitive dust emissions would be indistinguishable from background rates at a distance of 14 to 20 km from active mining areas (Rescan, 2006).

During 2008 over 10% of the HVAS filters returned negative values following analysis. During this time monitoring technicians were having problems with portions of the filter paper sticking to the rubber edge of the filter cassette, hence leading to negative TSP values being returned from the laboratory.

3.4.2 Continuous Air Monitoring (CAM)

CAM data from January through August 2008 were collected at the Grizzly Lake location. The station was not operational from August 21 until October 3, as this time was required for moving the building, set up and calibration. Data recorded after October 3, 2008 were collected at the new Polar Explosives site.

The EKATI mine site has adopted the CAAQO as operational targets, which are equivalent to the GNWT standards for TSP, $\text{PM}_{2.5}$ and SO_2 parameters. A summary of the territorial objectives was presented in Table 3.2-1 above and the CAAQO is provided in Table 3.2-2.

Hourly and daily average concentrations of the six air quality measures (SO_2 , NO_2 , NO, NO_x , $\text{PM}_{2.5}$ and TSP) collected for 2008 are presented in Table 3.4-2. The hourly and daily average concentrations for SO_2 , TSP and $\text{PM}_{2.5}$ are within the NWT standards.

Table 3.4-2. 2008 Continuous Ambient Monitoring

Location	Month	SO ₂ (ppb)		NO ₂ (ppb)		NO (ppb)		NO _x (ppb)		TSP (µg/m ³)		PM _{2.5} (µg/m ³)	
		1 Hr	24 Hr	1 Hr	24 Hr	1 Hr	24 Hr	1 Hr	24 Hr	1 Hr	24 Hr	1 Hr	24 Hr
Grizzly Lake	January	10	3.1	30	16.7	124	10.7	150	23.1	38	25.3	22	14
	February	2	0	37	23.3	39	7	70	27	83	24	12	4
	March	0 ^a	0 ^a	218	18.3	278	32.4	319	46.4	994 ^b	104.8 ^b	42 ^b	8.0 ^b
	April	10 ^c	2.4 ^c	77	56	56	14	104	65	86 ^d	16 ^d	37 ^e	10.7 ^e
	May	3 ^f	0.47 ^f	121	69.2	120	44.2	236	110.1	108	24.7	22	10.0
	June	9	3.0	399	153.6	361	137.9	525	268.5	361	45	14	7.6
	July	10	5.3	84	55.5	79	49.3	131 ^g	93.2 ^g	735 ^h	61.3 ^h	108 ⁱ	18.9 ⁱ
	August ^j	3	1.3	119	55.1	73	27.2	192	84	237	22.3	24	12.6
	September ^k	-	-	-	-	-	-	-	-	-	-	-	-
Polar Explosives	October	3	0.7	48	30.2	209	58.2	248	82.3	128 ^l	20.7 ^l	15 ^m	6.6 ^m
	November	5	1.9	323	132.4	73	55.4	370	167.7	156 ⁿ	18.4 ⁿ	50 ^o	3.5 ^o
	December	3	0.9	117	82	147	51.2	225	102	107 ^p	22.6 ^p	11 ^q	3.4 ^q

^a: A total of 660 hours of SO₂ data was invalidated during the month of March as a result of a disconnected wire found on the analog output of the SO₂ analyzer; the wire was reconnected on April 23, 2008.

^b: Five hours of PM_{2.5} and TSP data were invalidated due to power failures that occurred on March 7 and March 19.

^c: A total of 541 hours of SO₂ data was invalidated during the month of April due to a disconnected wire found on the analog output of the SO₂ analyzer; the wire was reconnected on April 23, 2008.

^d: A total of 565 hours of TSP data is unavailable due to an Envidas software upgrade error.

^e: Two hours of PM_{2.5} data was invalidated because of a power failure on April 15

^f: A total of 164 hours of SO₂ data was invalidated in May due to a loose wire found on the Data Acquisition System (DAS) coming from the SO₂ analyzer.

^g: A total of 41 hours of NO_x data was found to be invalid as a result of IZS and BOX temperature faults.

^h: Two hours of TSP data were invalidated as a result of the BAM filter tape running out.

ⁱ: One hour of data was invalidated as PM_{2.5} readings fell below -3 µg/m³. Note data is corrected in this fashion based on the Alberta Air Quality Guidelines; if the data was between 0 to -3 µg/m³, the data was corrected to 0. If the data were below -3 µg/m³, the data were invalidated.

^j: One hour of data was invalidated for all parameters due to a power failure that occurred on August 3. Additionally, during August 21-22 a removal calibration occurred in preparation for the relocation of the CAM building to the new sample location (Polar Explosives).

^k: Data are not available for the month of September due to relocation of the CAM building.

^l: Two hours of TSP data were invalidated due to a PFCC fault. Additionally, 21 hours of data were invalidated due to data being below -3 µg/m³.

^m: Two hours of PM_{2.5} data was invalidated because of a Power Factor Correction Circuit (PFCC) fault. Additionally, 12 hours of data were invalidated as readings fell below -3 µg/m³.

ⁿ: 38 hours of TSP data were invalidated due to readings falling below -3 µg/m³.

^o: 103 hours of PM_{2.5} data was invalidated because readings fell below -3 µg/m³.

^p: 45 hours of TSP data was invalidated due to readings falling below -3 µg/m³.

^q: 31 hours of PM_{2.5} data was invalidated due to several flow errors occurring during the month of December. Additionally, 78 hours of data was considered invalid because readings fell below -3 µg/m³.

The CAAQO standards for Maximum Tolerable Concentrations were met for all parameters. For SO₂ the hourly and daily averages throughout 2008 were below the CAAQO objectives for the Maximum Desirable Concentrations. The 2008 hourly and daily SO₂, TSP and PM_{2.5} concentrations were below the CAAQO Objectives for Maximum Acceptable Concentrations.

Exceedances of the Maximum Acceptable Concentration for NO₂ were observed in three months during 2008 (March, June and November). The CAAQO Maximum Acceptable Guidelines for NO₂ state that concentrations must be at or below 213 ppb and 106 ppb for hourly and daily averages respectively. The exceedances of this guideline occurred on:

- March, 2008: 218 ppb (1 hr average);
- June, 2008: 399 ppb (1 hr average) and 153.6 ppb (24 hr average); and
- November, 2008: 323 ppb (1 hr average) and 132.4 ppb (24 hr average).

In future AQMP reports, results from the CAM will be compared against previous years to assess temporal trends in changes in air quality. In addition, once three consecutive years of data have been collected at the new Polar Explosives site, a complete calculation of PM_{2.5} for comparison to the national standard will be completed.

3.5 DUSTFALL MONITORING

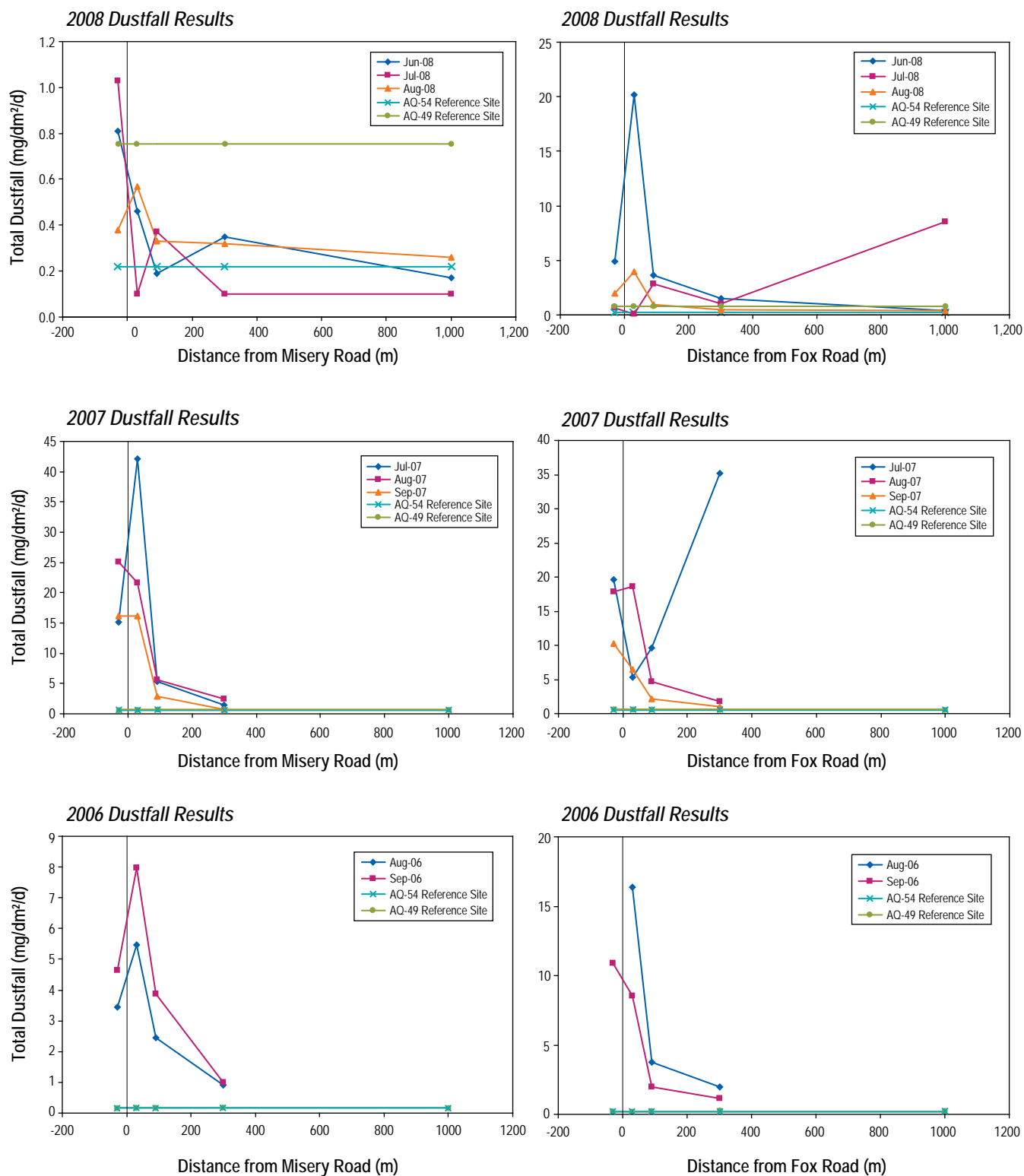
3.5.1 Total Dustfall

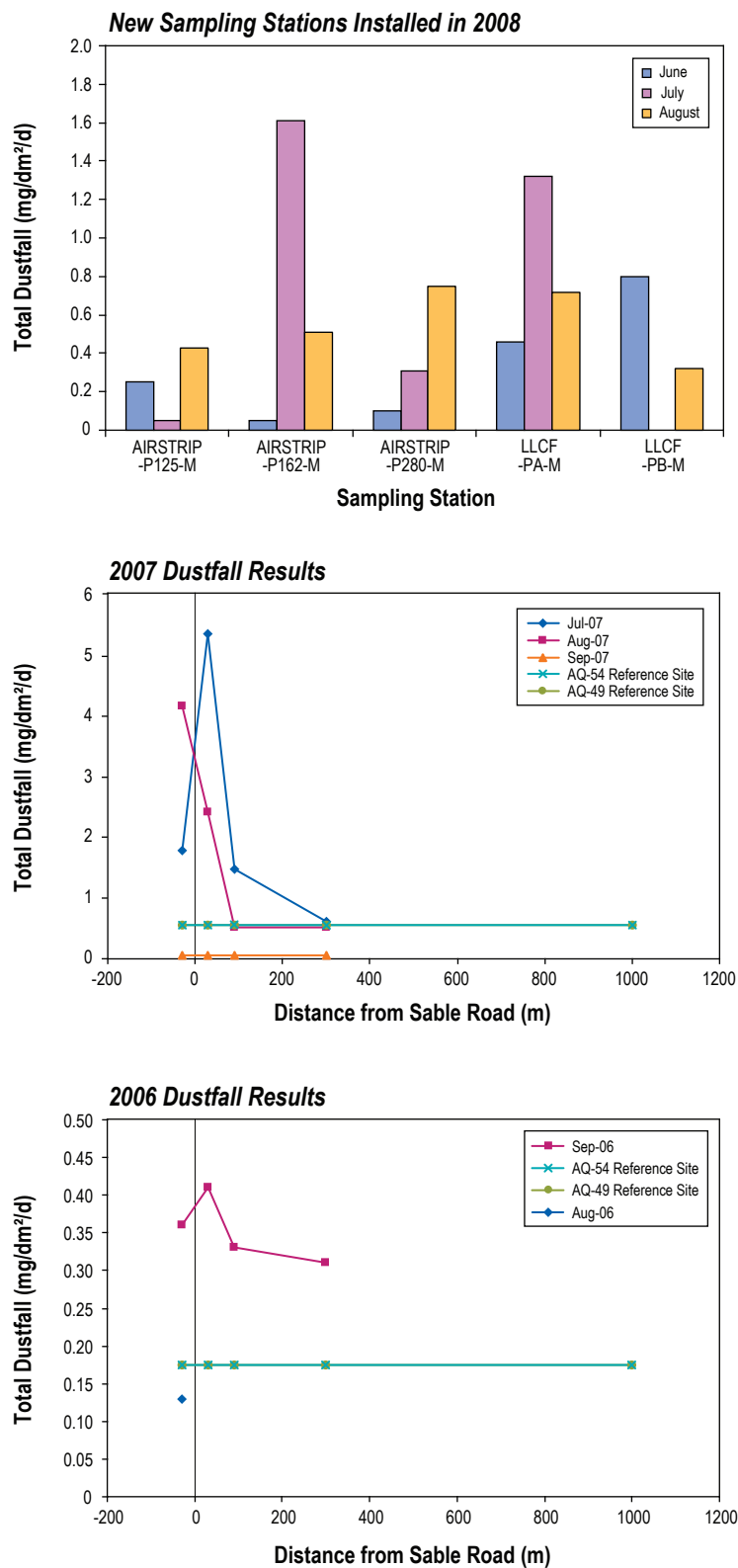
The dustfall monitoring program, initiated in 2006, was developed to determine the deposition patterns for fugitive dust from the haul road. There are no specific guidelines for fugitive dust deposition in the Northwest Territories. The 1979 British Columbia Pollution Objective for the Mining, Smelting and Related Industries for total particulate (sum of soluble and insoluble particulate) is 1.7 to 2.9 milligrams per decimetre squared per day (mg/dm²/d) as a 30 day average. This British Columbia dustfall objective is similar or slightly more stringent than other Canadian jurisdictions. The average 2008 reference concentration (0.22 mg/dm²/day) at AQ-54 did not exceed the guidelines. However, the 2008 average reference concentration (4.27 mg/dm²/d) at AQ-49 exceeded these guidelines due to an elevated dustfall concentration recorded on June 5th, 2008 (Appendix 4). The data point is considered an outlier, and its removal decreases the average 2008 reference concentration to 0.76 mg/dm²/day, which is lower than the guidelines. Potential reasons for sample bias causing this outlier in June 2008 may be due to a number of factors including contamination of the sample lid when screwed on to the collector or the helicopter landing too close to the dustfall collector and stirring up particulate.

Results for the complete suite of parameters for the 2006 to 2008 dustfall dataset are provided in Appendix 4. A summary of the key findings of the analysis is provided below.

In 2008, the Sable Road monitoring stations were disabled due to inactivity along this road. At the Fox and Misery haul roads additional dustfall monitors were installed to capture dustfall concentrations 1,000 m predominantly downwind of the road centreline (to address predications made in the 1995 EIS). In order to incorporate the 1,000 m station, while maintaining a straight transect, the location of the other dust monitors at Fox haul road had to be adjusted. Further, in 2008 an additional five dustfall monitoring locations were installed at the LLCF and Airstrip.

The results of the dustfall monitoring program are aligned with site activity for the monitoring years from 2006 to 2008 (Figures 3.5-1 and 3.5-2). In 2006 and particularly 2007, total dustfall near the Misery haul road (less than 90 m from the road centerline) was higher than observed in 2008 when all hauling activity along Misery road ceased.





2006-2008 Total Dustfall Measured at Sable Road, LLCF, Airstrip and Background Monitoring Stations

FIGURE 3.5-2



In 2008 total dustfall was higher near field to the Fox haul road compared to the Misery haul road. The Fox haul road continued to be used during 2008 when the Misery road had been deactivated.

Additional years of data collection at the airstrip and LLCF locations are required to make any general conclusions. However, the maximum total dustfall for all the new stations was within the same range as dustfall concentrations observed at the Misery and Fox haul road stations during 2008.

In 2008 an additional station 1,000 m from the centerline of the Fox haul road (FOX-D1000) was added to address 1995 EIS predictions. In June and August, dust levels had settled to background levels by the 1,000 m sampling point on the Fox haul road. Additional years of data collection at the 1,000 m station are required to confidently assess this observation.

An additional station 1000 m from the centerline of the Misery haul road (MIS-D1000) was added in 2008 to address 1995 EIS predictions. However there was no haul truck traffic in 2008 because all of the stockpiled ore had been moved to the process plant in 2007, making it difficult to identify trends (Figure 3.5-1). Total dustfall concentrations at all sites at the Misery Haul Road in 2008 were within or below the range of reference levels (AQ-54 and AQ-49).

The Sable haul road did not have haul traffic in 2007 and there was no dust suppression activity on this road during 2007. The data for total dustfall from Sable Road suggest that by 300 m the dust level settled to reference levels (Figure 3.5-2). The Sable haul road stations were removed in 2008.

Two major outliers were recorded in the dustfall data during the AQMP monitoring period of 2006 to 2008:

- July 1, 2007: Fox D300 = 35.2 mg/dm²/day (average at this site over the three years excluding this outlier is 1.3 mg/dm²/day)
- July 5, 2008: Fox D1000 = 8.52 mg/dm²/day (average at this site over the two months of monitoring in 2008 excluding this outlier is 0.38 mg/dm²/day)

These outliers go against the expected trend of decreasing total dustfall with distance from the road centerline. As described above possible causes of outliers in dustfall data could be due to contaminated sample jars or the helicopter landing too close to the sampling site stirring up excessive particulate. It is possible that the outlier observed on July 5th, 2008 is attributable to the tundra fire noted on the field data sheet for the HVAS program. Given that dustfall monitors collect particulate for a period of a month it is possible that fugitive emissions from a tundra fire could significantly influence the results of this sample.

Field data sheets for the above two samples were reviewed to ascertain any unusual conditions. Technician notes for these days did not identify any conditions/mine activities that may have led to elevated total dustfall results.

Similar to previous years at EKATI, dust suppression on the airstrip consisted of EK-35, applied in July of 2008. The initial results suggest that dustfall levels are less than reference levels at the airstrip stations (Figure 3.5-2). EKATI will continue to implement management actions including application of dust suppressants to limit dustfall from the mine site and reduce the mine's disturbance footprint.

3.5.2 Acid Deposition

Acid deposition is primarily a result of sulphur dioxide (SO₂) and nitrogen oxides (NO_x) emissions from industrial facilities. Environment Canada (EC) measures deposition in terms of 'critical load', which is defined as the amount of acid deposition a particular region can receive without being adversely affected. Chemical indicators of deposition are sulphate and nitrate anions (EC 2004). The units commonly used to quantify acid deposition and critical loads are kg/ha/yr. Deposition measurements taken from dustfall samples were in mg/dm²/d.

Estimates of critical load ranges have been established for both aquatic and terrestrial ecosystems for many areas of Canada. Terrestrial critical loads have yet to be established for the NWT or another region characterized by Tundra. Table 3.5-1 shows the range of established critical loads for soil in other Canadian jurisdictions that can be compared to loadings at EKATI to provide some context as to the likely effect of the mine on acid deposition (EC 2004).

The dustfall results (Appendix 4) show that for 2006 and 2007 sulphate and nitrate anions were reported in concentrations of mg/L (Rescan are currently liaising with the laboratory that completed the analysis (ALS Environmental) to obtain sample volumes for 2006/07 data). In 2008, the sulphate and nitrate results were reported as loadings of mg/dm²/day. The maximum concentration for sulphate and nitrate deposition observed in dustfall samples at any site during 2006 and 2007 were:

- Nitrate - 0.73 mg/L (July 1st, 2007 Mis D30); and
- Sulphate - 20.4 mg/L (August 2nd, 2007 SAB U30).

The maximum loadings of sulphate and nitrate reported for 2008 were:

- Nitrate - 0.00249 mg/dm²/d; 0.909 kg/ha/yr (August 5th, 2008 at MIS D1000)
- Sulphate - 0.0536 mg/dm²/d; 19.56 kg/ha/yr (July 5th, 2008 at LLCF-PA-P)

The results for 2008 show that acid deposition (20.47 kg/ha/yr) was below the median critical loads reported for different parts of Canada in Table 3.5-1. This is the sum of the sulphate and nitrate potential deposition, which is the one month worst case scenario extrapolated to one year. These estimates are conservative because it is unlikely that these maximum monthly values would extend for 12 months. In addition, it is important to note that the acid deposition calculations neglect the effect of neutralizing compounds found in dustfall and soil. Therefore, actual loading is likely well below this prediction.

Table 3.5-1. Established Critical Loads for Soil in Canadian jurisdictions (EC 2004)

Province	Median (kg/ha/yr)
Newfoundland	28
Nova Scotia	39
Prince Edward Island	99
New Brunswick	56
Quebec	25
Ontario	26

3.5.3 Metals Deposition

Metal deposition analytical results (Appendix 4) show that many parameters are at or below analytical detection limits. As a result, it was not possible to establish trends for metal deposition.

3.6 SNOW CHEMISTRY MONITORING

Summary statistics of the snow core chemistry are provided in Table 3.6-1. Results for the complete suite of parameters for the 2008 dataset are provided in Appendix 5. The 2008 results were compared to historical averages from 1998 to 2005. In general, the 2008 results are within the historical range, the average values from many parameters are below 1998 to 2005 values. Appendix 5 provides comparison of the analytical results of the duplicate samples collected.

Table 3.6-1. Summary of Chemical Analyses for Selected Parameters from 2008 Snow Sampling

Parameter	Units	# of Samples	# Below Detection Limit	Average	Median	Standard Deviation	Minimum	Maximum	1998 to 2005 Average
Alkalinity	mg/m ² /day	33	30	0.662	0.517	0.597	0.133	3.393	n/a
Ammonia	mg/m ² /day	33	13	0.007	0.002	0.012	0.001	0.059	0.053
Anion Sum	meq/L	33	31	0.029	0.026	0.019	0.007	0.108	n/a
Bicarbonate-Alkalinity CaCO ₃	mg/m ² /day	33	33	1.000	1.000	0.000	1.000	1.000	n/a
Cation Sum	meq/L	33	22	0.101	0.032	0.227	0.007	1.194	n/a
Conductivity	µS/cm	33	5	6.387	4.200	7.431	2.000	42.300	4.981
Fluoride	mg/m ² /day	33	33	0.005	0.005	0.002	0.001	0.010	n/a
Nitrate	mg/m ² /day	33	13	0.023	0.015	0.024	0.000	0.084	0.081
pH	log	33	0	5.478	5.360	0.353	5.050	6.580	5.413
Sulphate	mg/m ² /day	33	17	0.158	0.124	0.125	0.028	0.528	0.412
Total Organic Carbon	mg/m ² /day	33	3	1.422	0.991	1.288	0.168	4.853	n/a
Total Suspended-Solids	mg/m ² /day	33	4	9.695	5.513	12.229	0.602	63.455	26.42
Turbidity	NTU	33	1	7.112	4.020	8.199	1.500	41.400	9.554
Total Metals									
Aluminum	mg/m ² /day	33	1	0.217	0.070	0.359	0.012	1.910	0.340
Arsenic	mg/m ² /day	33	5	0.000	0.000	0.000	0.000	0.000	n/a
Barium	mg/m ² /day	33	2	0.006	0.002	0.014	0.000	0.080	0.010
Beryllium	mg/m ² /day	33	33	0.000	0.000	0.000	0.000	0.000	n/a
Boron	mg/m ² /day	33	17	0.001	0.001	0.001	0.001	0.003	n/a
Cadmium	mg/m ² /day	33	25	0.000	0.000	0.000	0.000	0.000	n/a
Calcium	mg/m ² /day	33	3	0.253	0.120	0.438	0.014	2.161	0.376
Chromium	mg/m ² /day	33	2	0.001	0.000	0.004	0.000	0.019	0.002
Cobalt	mg/m ² /day	33	15	0.001	0.000	0.002	0.000	0.007	n/a
Copper	mg/m ² /day	33	8	0.001	0.000	0.001	0.000	0.005	0.006
Iron	mg/m ² /day	33	2	0.265	0.063	0.643	0.009	3.462	0.484
Magnesium	mg/m ² /day	33	2	0.568	0.123	1.576	0.014	8.419	0.440
Manganese	mg/m ² /day	33	2	0.010	0.005	0.014	0.000	0.070	0.053
Mercury	mg/m ² /day	33	33	0.000	0.000	0.000	0.000	0.000	n/a
Molybdenum	mg/m ² /day	33	2	0.013	0.005	0.021	0.000	0.088	n/a
Nickel	mg/m ² /day	33	1	0.005	0.001	0.013	0.000	0.072	0.053
Phosphate	mg/m ² /day	33	2	0.016	0.009	0.019	0.001	0.076	0.038
Potassium	mg/m ² /day	33	5	0.201	0.107	0.276	0.007	1.301	0.268
Silicon	mg/m ² /day	33	1	0.730	0.126	1.995	0.010	10.555	n/a
Sodium	mg/m ² /day	33	2	0.091	0.048	0.154	0.013	0.896	0.123
Strontium	mg/m ² /day	33	2	0.006	0.002	0.014	0.000	0.068	0.053
Uranium	mg/m ² /day	33	5	0.000	0.000	0.000	0.000	0.000	n/a
Vanadium	mg/m ² /day	33	2	0.001	0.000	0.002	0.000	0.009	0.053
Zinc	mg/m ² /day	33	23	0.007	0.003	0.010	0.001	0.036	0.053

Spatial trends in the 2008 snow chemistry data were assessed through the analysis of surface loading rates as a comparison against distance from the nearest centre of mining activity (Fox Pit or Main Camp). Positive relationships were observed for a number of variables likely associated with fugitive dust and fine particulates. Loading rates were the highest close to the mine source, and dropped off quickly with increasing distance. Figures 3.6-1 and 3.6-2 show examples of this spatial trend for crustal elements aluminum, chromium, and TSS.

The same spatial analysis was conducted for nitrate (NO_3^-), ammonium (NH_4^+) and sulphate (SO_4^{2-}). These compounds are associated with combustion and blasting at the mine. NO_3^- and SO_4^{2-} are of special concern as they are associated with acid deposition, which is known to have harmful effects on terrestrial and aquatic ecosystems. No spatial trends were observed in these elements with distance (up to 50 km) from mining activity (Figure 3.6-2). In general, concentrations of nitrate, ammonia and sulphate are well within the range of expected background concentrations at all sampling locations (Figure 3.6-2).

The effects of volatile compounds (S and N) are limited to the active mining areas surrounding EKATI. The higher concentrations of volatile compounds observed at reference sites is likely to be attributed to external sources such as arctic haze or long range transport. These findings are in agreement with the results from the CALPUFF air dispersion modelling and also those presented in the 2005 AQMP. The coefficients of correlation (R^2) of the trendlines for NO_3^- , NH_4^+ and SO_4^{2-} and distance from nearest source are very low; 0.0145, 0.004 and 0.012, respectively (Figure 3.6-2), suggesting that there is no direct relation between these concentrations and the distance from the mining activities. Thus also suggesting that the mining activities do not have significant effects on the volatile compounds.

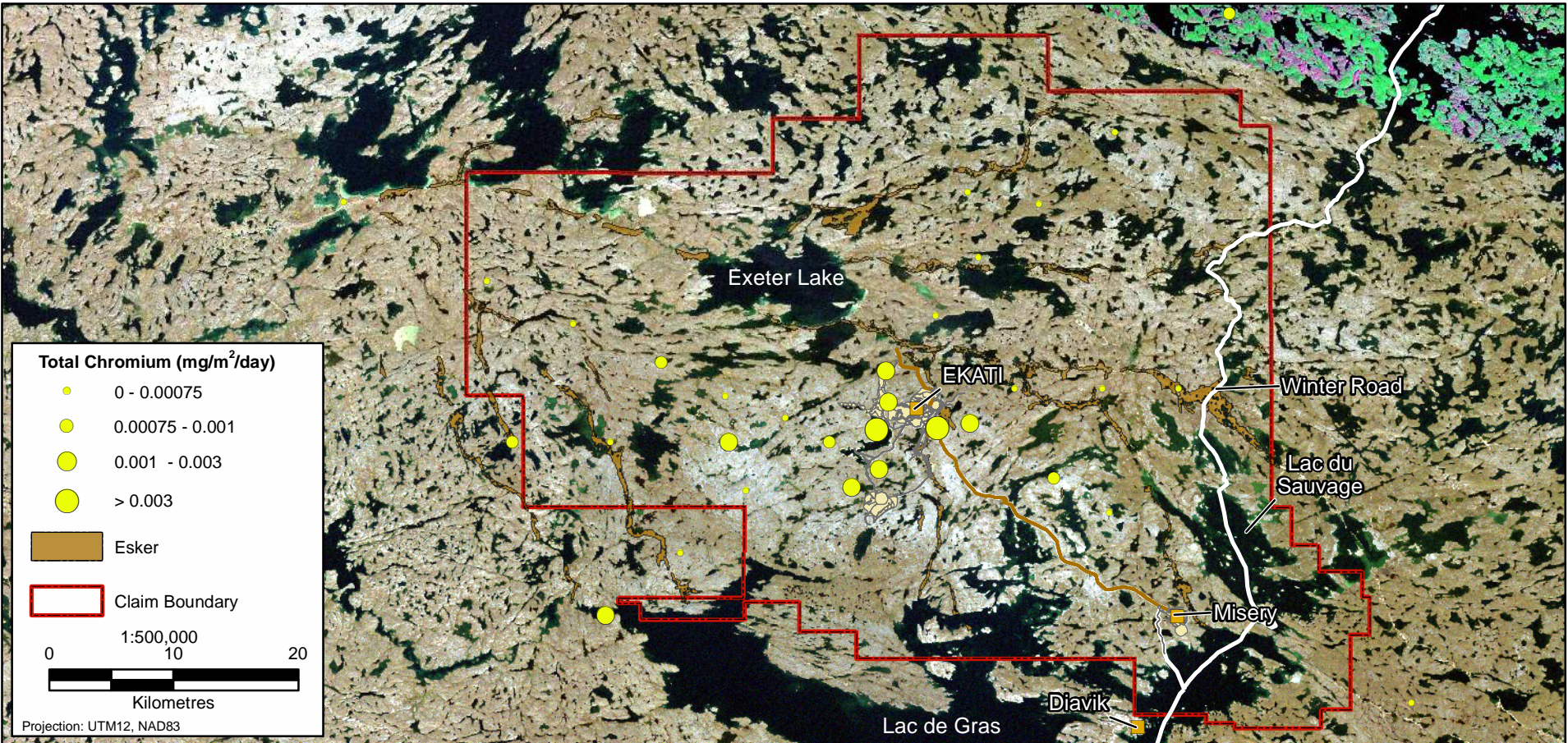
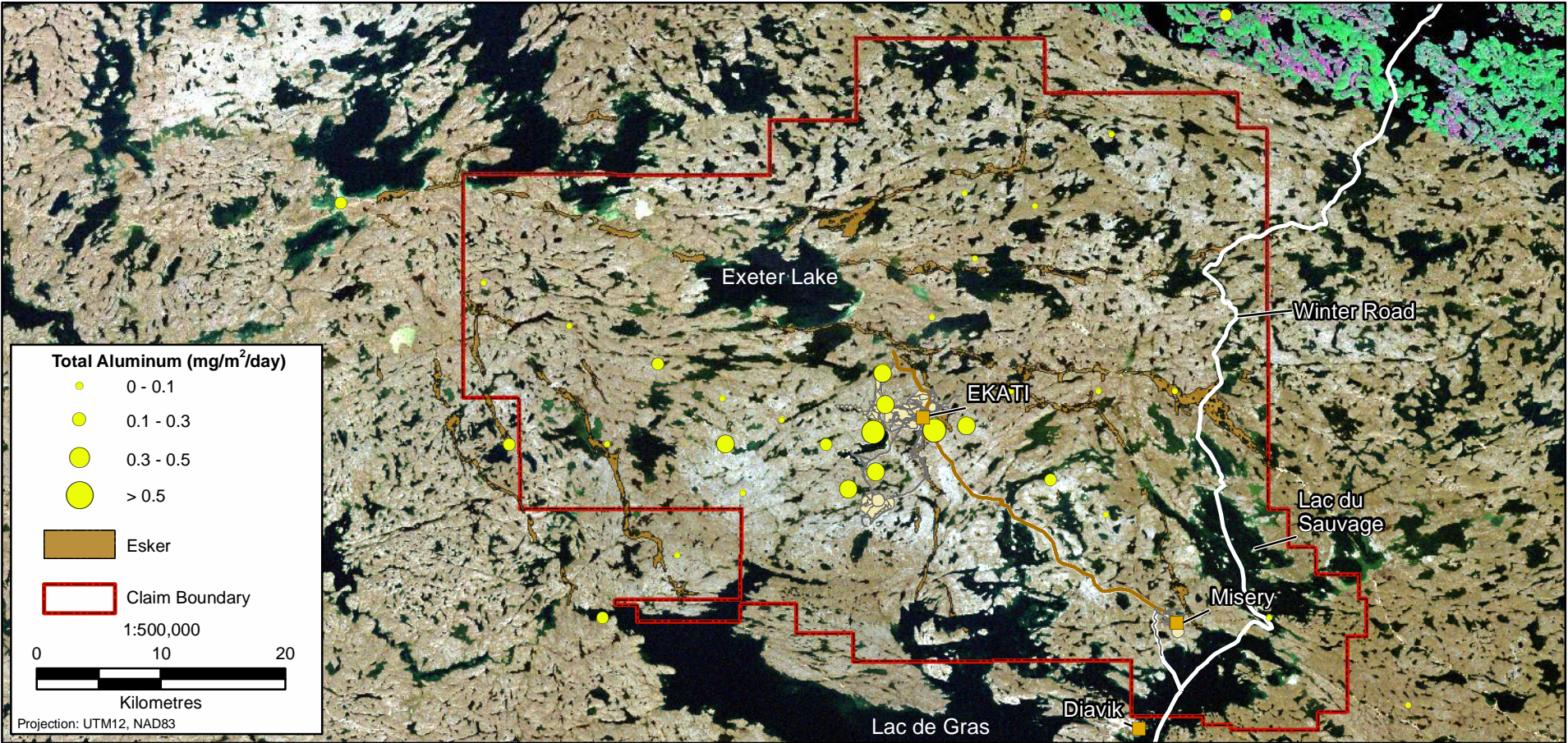
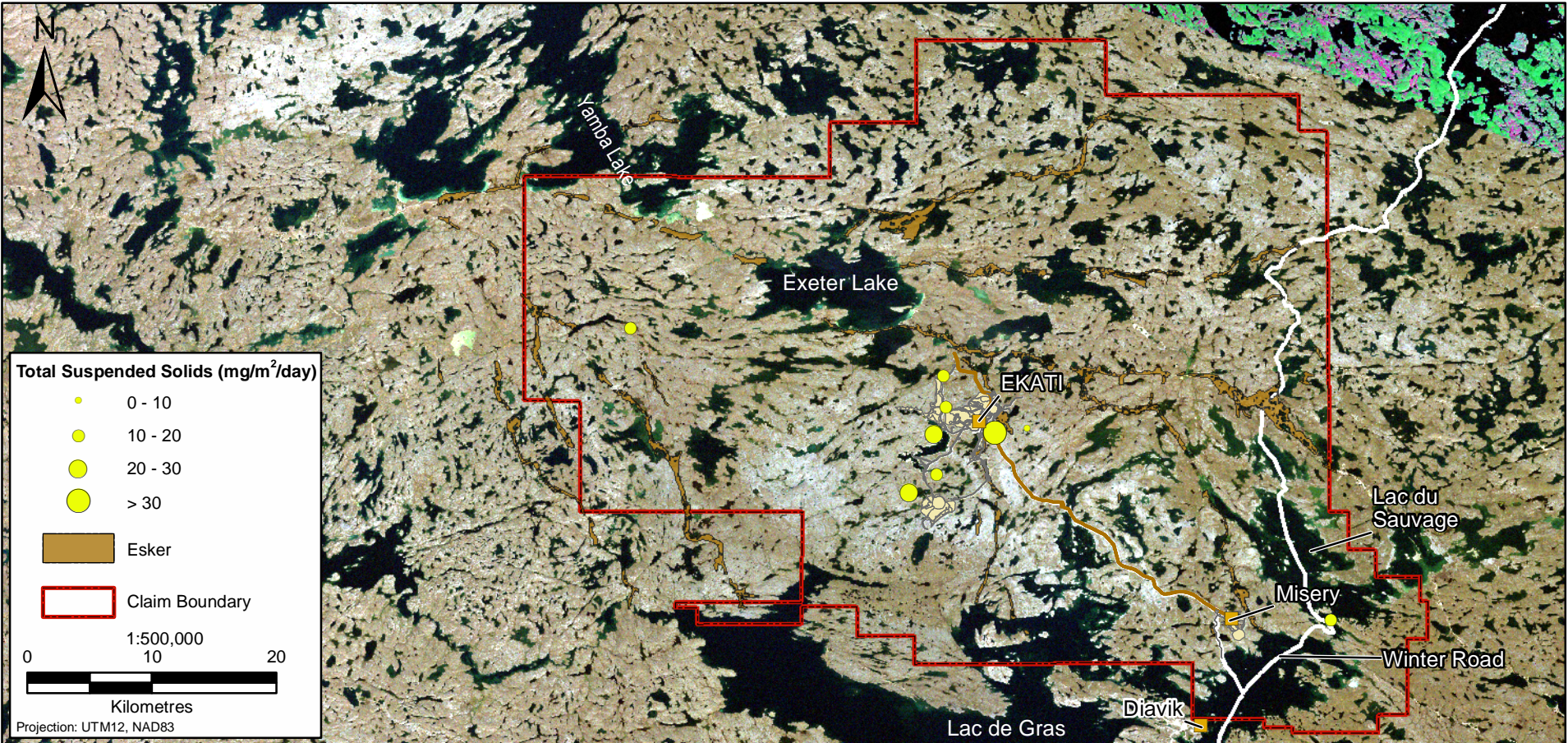
Background conditions are presented based on 20 years of precipitation monitoring data (1988 to 2008) from Snare Rapids. Snare Rapids is a Canadian Air and Precipitation Monitoring (CAPMoN) station located approximately 150 km northwest of Yellowknife and 150 km southwest of EKATI. CAPMoN stations are locations considered to be remote and pristine.

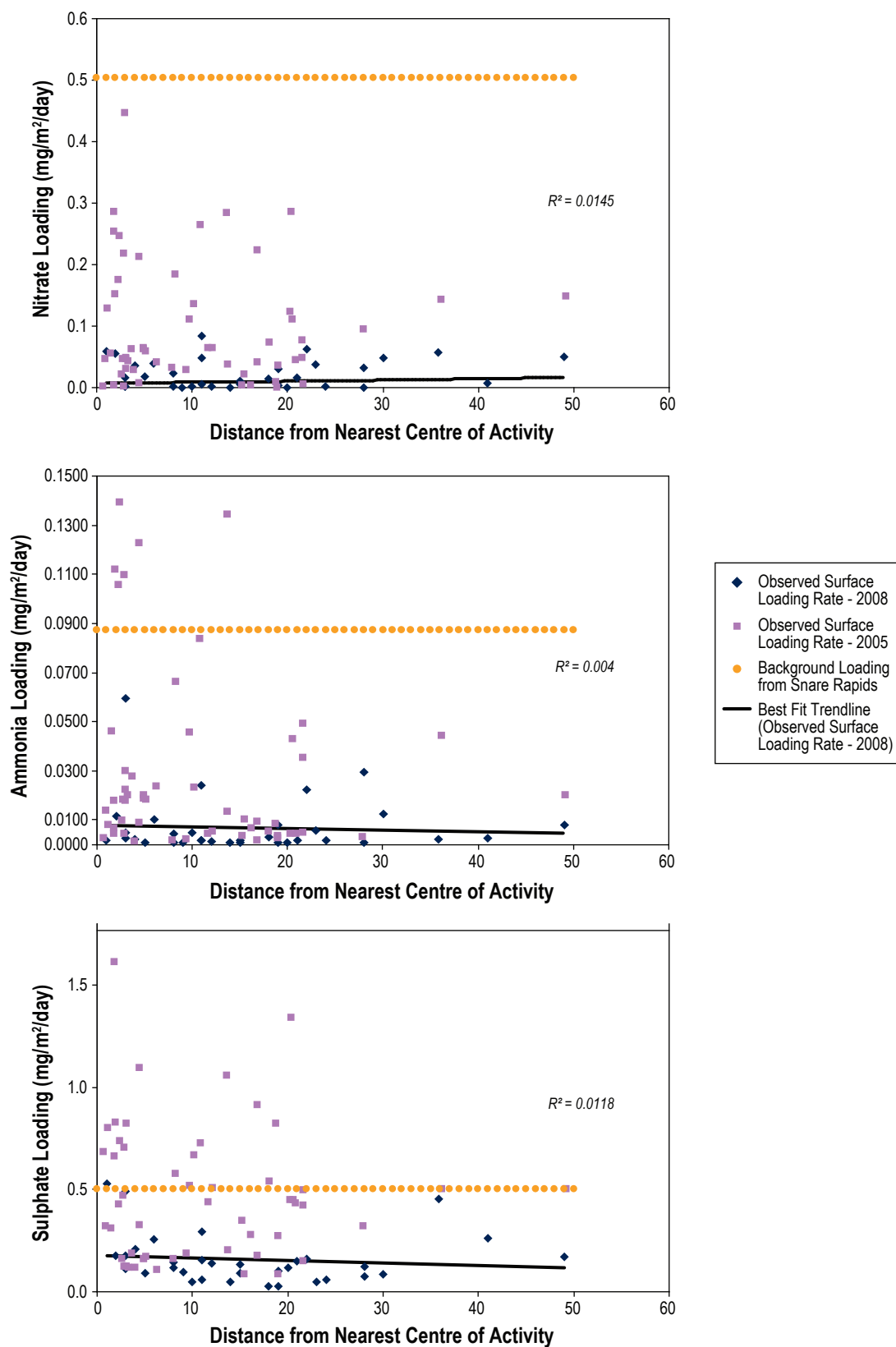
A comparison was made between concentrations of volatile compounds nitrate, ammonia and sulphate between 2005 and 2008. Results illustrated on Figure 3.6-2 indicate that at a number of locations in 2005, samples exhibited higher concentrations of all three compounds compared to 2008. However, the concentrations of these compounds are very low for both years (mostly below background levels).

Future monitoring will assist in establishing trends relating to regional activities or naturally occurring events, such as long range transport and arctic haze, on deposition of volatile compounds such as sulphates and nitrates. Several years of data will be required in order to make a reliable assessment.

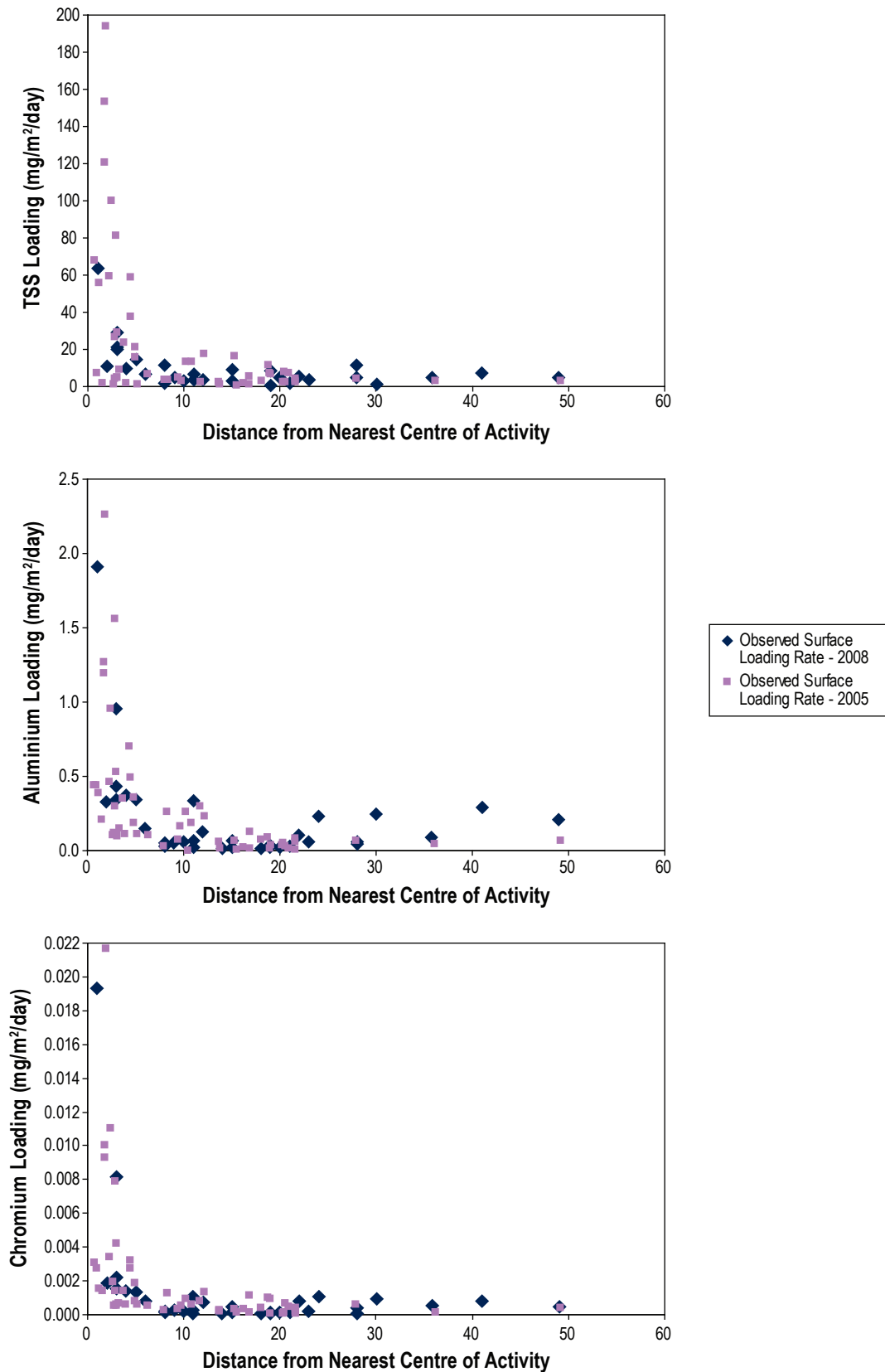
It should also be noted that for cases where NO_3^- and SO_4^{2-} concentrations were observed to be higher with increasing distance from the mine compared to other nearby stations, the measured concentration were low and close to background levels and detection limits. Variability in concentrations is expected among samples because they were near and below detection limits (0.2 and 0.005 mg/L for SO_4^{2-} and NO_3^- , respectively).

Unlike the results for nitrate, ammonia and sulphate, the results presented in Figure 3.6-3 for TSS, aluminum and chromium showed concentrations within the same range for the samples analysed in 2005 and 2008. This is likely due to the fact that for non-volatile elements such as aluminum and chromium, contributions from the mining activities have remained the same between these years.





Note: Background loading rate based on the daily average loading from 20 years of winter data (October to May) at Snare Rapids (1988 to 2008).



3.7 LICHEN TISSUE MONITORING

3.7.1 Overview

Lichens were collected from 37 sites in 2008 near EKATI and compared to similar collections made in 2005 (Figure 2.6-1). Lichens are useful indicators of the distribution of dust, particulate and air emissions from a variety of sources, including but not limited to road dust, mine sites and vehicle exhausts. The chemical analysis of lichen tissue provides a precise measurement of ambient air pollution changes over time. A total of 28 chemical parameters were analysed from the lichen tissue lab results. The detailed lab analysis data are provided in Appendix 6.

Concentrations of the elements in lichen tissue from the sampling stations around EKATI are similar to published background levels from the literature (Table 3.7-1).

Table 3.7-1. Comparison of Four Crustal Element Concentrations in Similar Lichens from the Literature versus Those Found at the EKATI Mine

Element	Background Concentrations from the Literature ¹	EKATI Mine Concentrations
Copper	6-20 ppm in <i>Parmelia sulcata</i>	4.8 ppm - 18.5 ppm in <i>P. rufescens</i>
	<1-50 ppm in Canadian Arctic Background Areas	0.88 ppm - 11.20 ppm in <i>F. cucullata</i>
Chromium	0.5-10 ppm in <i>P. sulcata</i>	0.6 ppm - 22 ppm in <i>P. rufescens</i>
	0-10 ppm in Canadian Arctic Background Areas	0.5 ppm - 12 ppm in <i>F. cucullata</i>
Zinc	50-80 ppm in <i>P. sulcata</i>	32 ppm - 70 ppm in <i>P. rufescens</i>
	200-500 ppm in Canadian Arctic Background Areas	11 ppm - 56 ppm in <i>F. cucullata</i>
Manganese	5-120 ppm in <i>P. sulcata</i>	68.9 ppm - 357 ppm in <i>P. rufescens</i>
	10-130 ppm in Canadian Arctic Background Areas	25.3 ppm - 228 ppm in <i>F. cucullata</i>

¹Bargagli and Mikhailova (2002), Nieboer et al. (1978), Rhodes (1999), Nash and Gries (1995).

Table 3.7-1 shows that maximum concentrations at EKATI are higher than average background concentrations reported in the literature for manganese, but not for copper or zinc. Chromium concentrations are similar to and slightly greater than background concentrations. These comparisons indicate that while enhancement from dust may be occurring near the mine site, the concentrations remain comparable to non-impacted background levels in the world, with some exceptions for stations located within close proximity to active roads or mining operations.

These values from the literature are important in interpreting if enhancement from wind borne dust has occurred as a result of mine site activity or other local sources. For example, other sources of wind borne dust, such as exposed rock or exposed sand eskers, may contribute to crustal element accumulation in lichens in addition to mine sources. However, the physical and chemical compositions of dust sources generated from mining sources, such as road or pit dust, as opposed to natural sources, such as exposed eskers, are different. In general, the finer silts that make up transported dust from roads and mine pits tend to exhibit higher calcium and magnesium concentrations than natural dust originating from sands. These factors were taken into consideration in the lichen analysis to recognise the influence of local, non-mine related sources.

3.7.2 Nitrogen and Sulphur

A number of studies around the world have demonstrated that nitrogen concentrations in lichens can range significantly because lichen species differ in their ability to absorb nitrogen and also because atmospheric and pollution-related sources of nitrogen exist. Nitrogen concentrations can range from 6,000 to 50,000 ppm as a world background, whereas at the EKATI mine, the nitrogen fixing lichen

Peltigera spp. (rufescens group) had nitrogen concentrations ranging from 2,100 ppm to 3,970 ppm. The non-nitrogen fixing *F. cucullata* had nitrogen concentrations ranging from 320 ppm to 640 ppm. Figure 3.7-1 shows the distribution of nitrogen in *F. cucullata*.

Figure 3.7-1 shows that nitrogen concentrations can be high near the mine, but also can be sporadically high at distances from the mine. Some of the enhancement may be due to a fertilizer effect from barren ground caribou. Stations located closer to mining activity may have been influenced by ammonium sulphates and NO_x from vehicle and stationary exhaust operating in active areas. Further, these substances tend to accumulate in the arctic and they can not be attributed to local sources alone due to the potential for long range transport of nitrogenous compounds, particularly in summer (Ishizaka et al., 1989). The results indicate that vehicle exhaust and other source emissions of NO_x are contained near the mine site, and that widespread atmospheric enhancement is influencing nitrogen concentrations in reference areas.

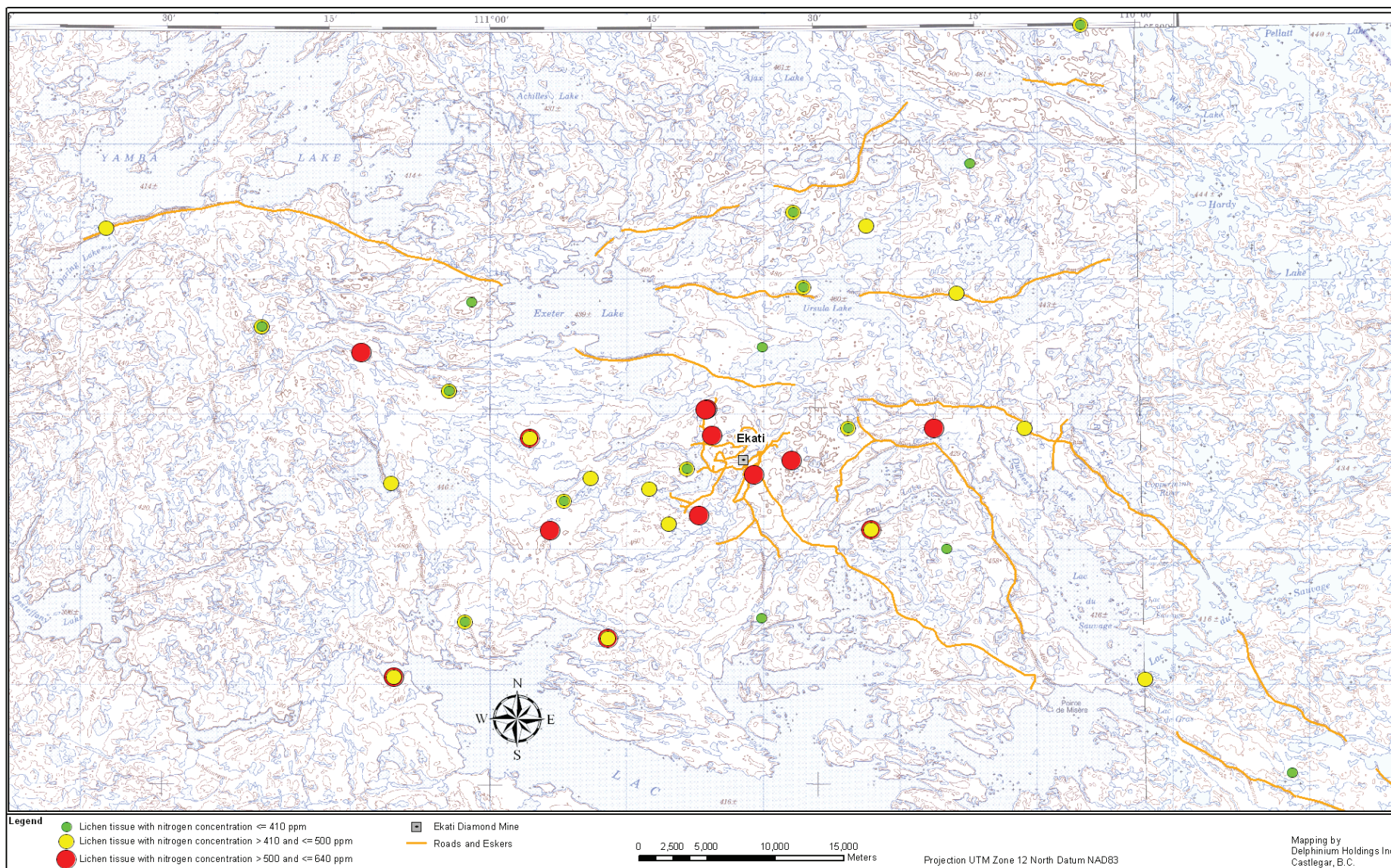
Figure 3.7-2 shows the distribution of concentration classes of sulphur in the tissue of *F. cucullata*. Background concentrations of sulphur in lichens taken from a variety of sources including arctic, sub-arctic, boreal and Canadian Shield Lichen studies range from 50 to 2,000 ppm (Nieboer et al., 1978). At EKATI the concentrations of *P. rufescens* ranged from 253 ppm to 1,760 ppm and in *F. cucullata* from 258 to 681 ppm. One of the highest concentrations measured was at reference station AQ-55, a GNWT scientific research camp at Yamba Lake. The research camp has a diesel generator operating, which is likely contributing to the small spike in sulphur concentrations at this location. In general, the concentrations of sulphur are considered well below background levels and have not reached concentrations expected to occur in industrial or even rural areas of Canada. Industrial and rural concentrations of sulphur range as high as 4,800 ppm (Nash and Gries, 1995).

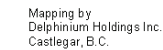
Although sulphur and nitrogen show considerable variation in concentration over the landscape, crustal elements attributable to dust appear to be contained to areas near the mine. Results also show higher concentrations of these elements in lichens to the south and southwest of the mine site buildings in addition to the cluster surrounding the mine site. In contrast to most of the non-volatile metals and crustal elements, which tend to decline with distance from the mine site, sulphur and nitrogen concentrations seem to have a more generalized distribution. Concentrations of sulphur and nitrogen in lichen tissue reflect local sources, but can also be attributed to arctic haze and subsequent bioaccumulation from depositional materials that can re-volatilize.

3.7.3 Comparisons between 2005 and 2008

The 2006 to 2008 lichen data collected at EKATI were useful for identifying spatial trends in air quality parameters as described above. Temporal trends can be assessed with data available from the previous 2002 to 2005 AQMP. Temporal trends prior to this date cannot be assessed due to limitations resulting from inconsistencies in historical data. Changes made to the lichen program in 2005 have rectified these inconsistencies and future monitoring data will continue to be used to assess temporal trends in changes to air quality.

Fourteen sites were sampled in both 2005 and 2008 that were used for comparisons of element concentrations in *F. cucullata* tissues between years. A total of 24 elements were measured in *F. cucullata* tissue in both 2005 and 2008. Section 4.2 of Appendix 3 provides more information on the sites collected in 2005 and 2008 and presents graphs for each of the 24 elements showing the variations in concentrations according to distance from the mine. The results for the key parameters are summarized below.





Six elements clearly show higher concentrations in lichen tissues in 2005 compared to 2008. These are aluminum (Al), arsenic (As), lithium (Li), molybdenum (Mo), uranium (U) and vanadium (V). Figure 3.7-3 shows an example of this relationship for As.

The comparisons made for barium (Ba), copper (Cu) and mercury (Hg) suggest the opposite relationship; with average concentrations in lichen tissues slightly higher in 2008 than in 2005 (see Figure 3.7-3 for Hg example). However, the concentrations of these elements, as well as those listed above, are very low for both years and although the differences are statistically significant, the concentrations are very low in relation to reference values.

Some elements did not show any clear trends in terms of differences between years including manganese (Mn), nickel (Ni), thallium (Tl), zinc (Zn), cadmium (Cd), calcium (Ca); and chromium (Cr).

In both years (2005 and 2008), the concentrations are roughly inversely proportional to the distance from the mine (declined with distance) for Al, Cd, Ca, Co, Pb, Li, Mg, Mo, Ni, U and V. Figure 3.7-3 shows an example for nickel.

The lichen collections made near the EKATI mine in August of 2008 shows that the dispersal of dust from the EKATI mine site and roads is primarily confined to near the mine site.

3.7.4 Visible Dust on Lichens

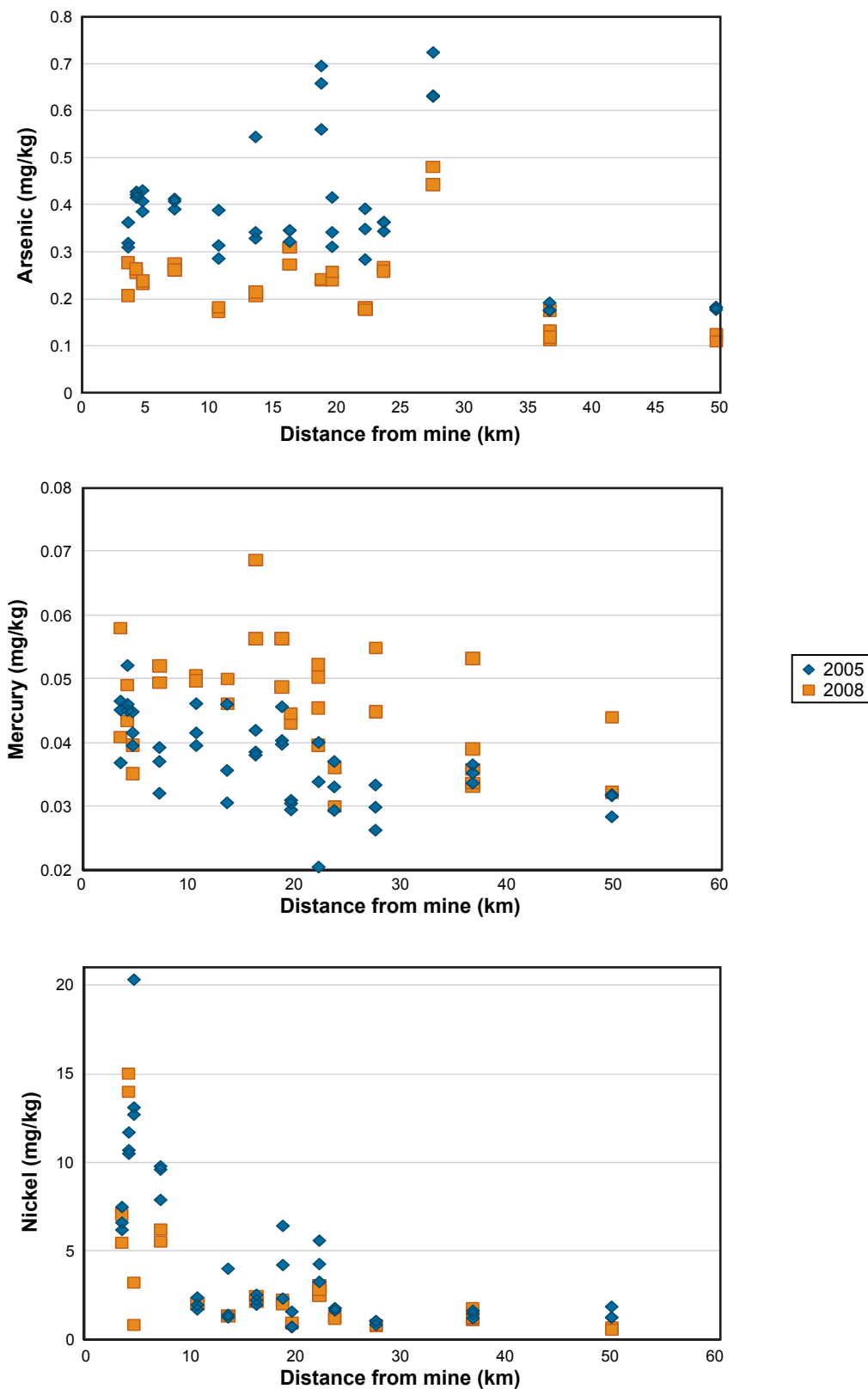
Lichens have been used to show the transport of dust from seasonal road use in a variety of locations around the world, including northern mining sites. They accumulate precise quantities of elements from road dust over a period of years of exposure, and their concentrations will decline in concentrations over time if road use decreases (Williamson et al., 2008; No, et al., 2006; Kapu, et al., 1991).

There was no visible dust apparent on the surfaces of vegetation in any of the lichen plots at EKATI. Visible dust observed on vegetation often results in high concentrations of crustal elements in lichen tissues. In addition to this lack of visible evidence of smothering, none of the concentrations of crustal elements analyzed could be considered high, although the impact of localized dust was apparent in lichens from plots located within the direct vicinity of the mine.

Two plots had somewhat elevated crustal element concentrations in lichen tissue that were likely due to enhancement from road dust. These effects occurred at plots AQ-2 and AQ-116. AQ-2 is located directly adjacent to a mine access road. Dust was noted on the road margins at AQ-2 but diminished at a distance of approximately 3 m from the road edge. AQ-16 is located within 1 km of an ice road (winter road north to Contwoyto Lake). Although this ice road was not constructed or used in the winter of 2007/2008 it is likely that accumulation in the tissue has occurred over the years of exposure, and will decline over time if dust is abated. Neither AQ-2 nor AQ-116 had crustal element concentrations that exceeded industrial levels (Rhoades, 1999: see also Table 3.7-1); they merely showed slight road dust effects.

3.7.5 Comparisons of Elements in Lichens and Dustfall

Lichen element concentrations in 2008 related well to the dustfall concentrations where sampling locations coincided for lichen and dustfall. Dustfall concentrations of elements in lichen tissues were compared for seven sites that had both sets of data available. The dustfall sites used in the analysis, as well as the corresponding sites for which lichen tissues were analyzed, are presented in Table 3.7-2.



Concentrations of Arsenic, Mercury and Nickel (As, Hg, Ni) in Lichen Tissues in 2005 and 2008 According to the Distance from the Mine

FIGURE 3.7-3



Table 3.7-2. Sites where Element Concentrations were Available for Dustfall and Lichen Tissues

Dustfall Sites	Corresponding Lichen Sites
AQ-49	AQ-49
AQ-54	AQ-54
LLCF-PA	AQ-5
LLCF-PB	AQ-31
AIR-280	AQ-29
FOX-U30/D30D90 (averaged)	AQ-19
FOX-D1000	AQ-4

Different relationships seemed to occur for different elements. However, in general the lichen data show a decline in the effects of dust with increasing distance from the mine.

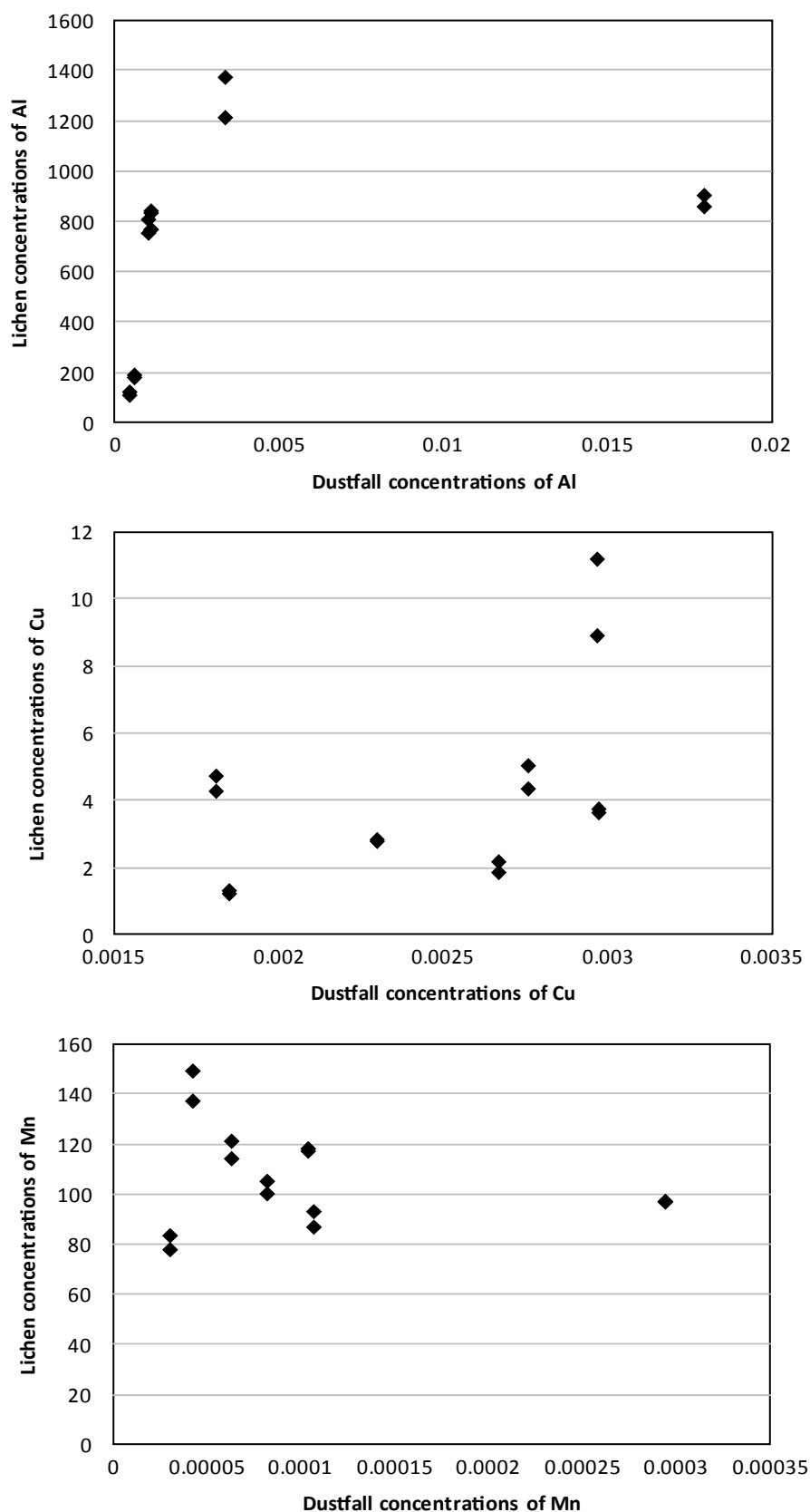
Analysis clearly shows that for most elements, a direct relationship exists. This was true for the volatile sulphur, and the crustal elements Al, Ba, Cd, Ca, Co, Pb, Mg, Mo, Ni and Sr. For Al, Ba, Co, Pb, Mg and Ni, the site AQ-19 was an outlier. However, concentrations at that site were relatively low compared to higher concentrations of elements in dustfall. This may be due to topographical sheltering of the lichens and higher exposure of the dustfall collectors near AQ-19. Figure 3.7-4 shows an example for Al and also shows the effect of the outlier at AQ-19.

Concentrations of Cd at site AQ-5 and concentrations of Ca at site AQ-49 were also atypical in the same fashion (low lichen concentrations for relatively higher dustfall concentrations). These differences are most likely due to dustfall monitors being placed conservatively, near dust sources such as roads, where lichen monitoring sites have a tendency to be located at distances from roads, in less impacted micro-sites.

Other elements such as Cu, Li, Hg and Zn, as well as N, also showed a positive relationship between lichen and dustfall concentrations. These were less linear and more exponential and possibly indicate passive uptake by lichens (see Figure 3.7-4 for Cu example). Concentrations of Mn in lichens seemed to decline with an increase of Mn in dustfall, as shown in Figure 3.7-4.

A Redundancy Analysis (RDA) was performed to assess which elements in dustfall strongly influenced the uptake of elements by *F. cucullata* at nearby sites. According to the results of the RDA, zinc (Zn) and Sulphur (S) explained 40% of the variation of all elements concentrations in lichens.

The results suggest that concentrations of Zn and S in dustfall have links to element concentrations in lichen tissues. Concentrations of Zn in dustfall are positively linked to the concentrations in lichen of Mn, Sr, As, Pb, Ca, Hg, Cd, Cu and N, as well as concentrations of S. Concentrations of S in dustfall were positively associated to concentrations of Cr, Li, U, V, Mg, Co, Ni, Tl, Al and Ba in lichen tissues, and negatively linked to Mn and Zn. These results suggest that increases in Zn or S concentrations in lichen tissue are a reasonable marker for increased dust effects to vegetation at EKATI.



Concentrations of Al, Cu and Mn in Lichen Tissues Compared to Concentrations in Dustfall around the EKATI Mine

FIGURE 3.7-4



3.7.6 Comparisons of Elements in Lichens and Snow Cores

The relationship between snow water element concentrations and lichen or moss uptake is frequently used as a way of examining the patterns of dust dispersion from point sources (Walker et al., 2003; Richardson, 1988; Beck and Ramelow, 1990; Tomassini et al., 1976). Snow measurements represent a conservative and maximum measurement of accumulated particulate in winter (Reimann et al., 1995; Bales et al., 1993; Cheng et al., 1993; Walker et al., 2003a), whereas concentrations of elements in lichens are an accurate measurement of longer-term depositional/exposure patterns of particulate matter of gasses, whether it's from snow melt water or dry deposition / gas exposure (Bargagli and Nimis, 2002). Source apportionment between road dust and emissions from exhaust, dust plume drift from construction, and emissions from industrial roasting/smelting of metals and fluoride, coal-fired plants and fertilizer plants have all been characterized using a combination of snow water chemistry and lichen or moss uptake (France and Coquery, 1996; Walker et al., 2003). The relationship between elemental concentrations in water or tissue and distance from sources is often interpreted as a signature for a particular emission or dispersed substance. Concentrations and the change in ratios over time of elements are also used to define the extent to which dust is dispersed versus long range transport or geogenic (bedrock) sources (Walker et al., 2003a).

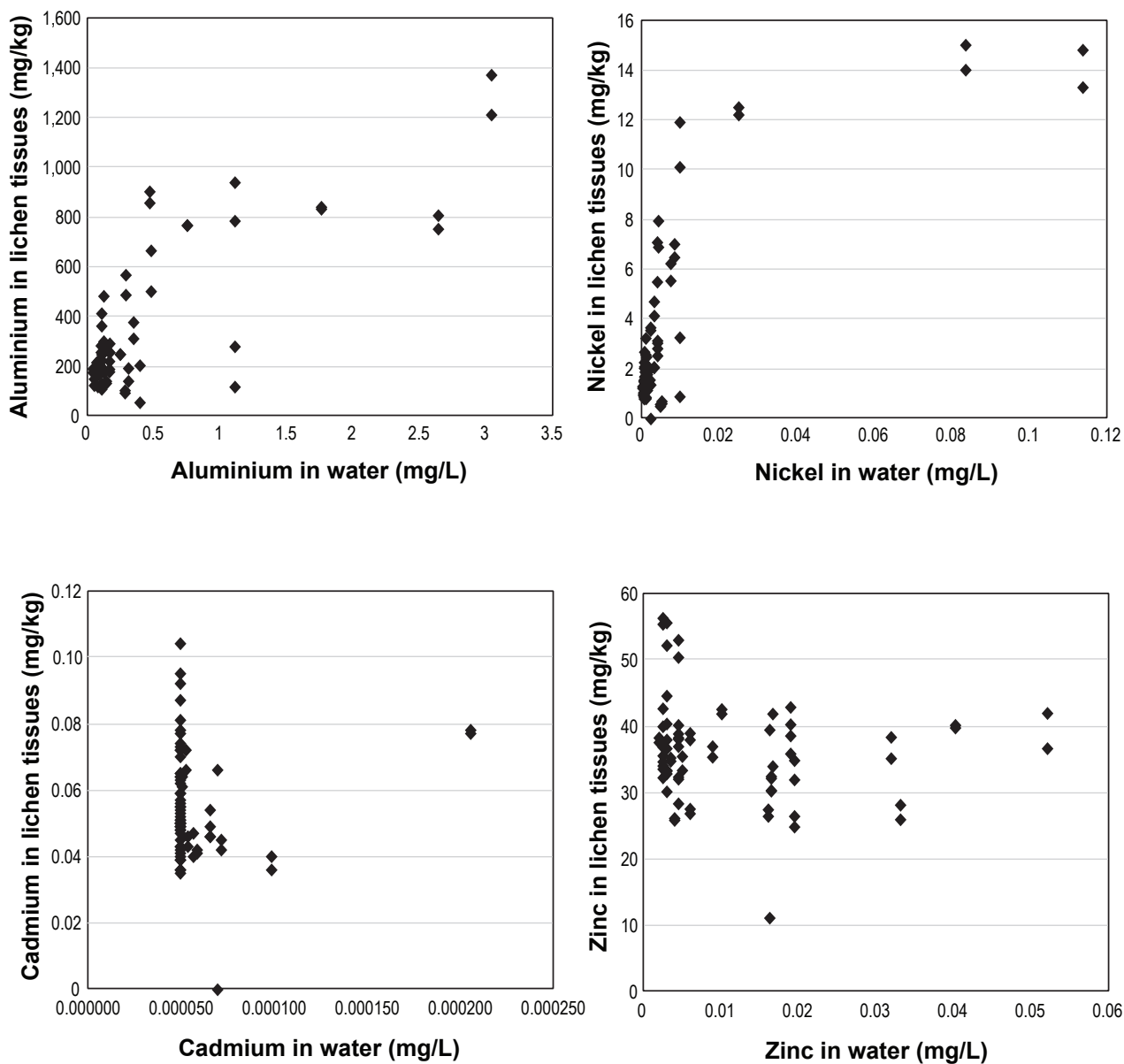
Concentrations in lichen tissues (*F. cucullata*) collected from 32 sites near the EKATI mine in 2008 were compared to the concentration of the same elements in snow water samples.

The data from snow and lichen measurements made in 2008 indicate that a relationship between some elemental concentrations in snow water and lichen tissue is relatively strong. Examples of both strong and weak relationships are provided in Figure 3.7-5.

As seen in the figures presented in Section 3.5, some of the elements associated with road dust decline over distance from EKATI, and some elements do not show a relationship with distance. A weak or non-existent relationship with distance is an indication that the element in question is not a major component of dust or emissions from the mine, and may be influenced more by background geogenic (rock or local soil) sources, or from long range transport (Walker et al., 2003a). Figure 3.7-5 illustrates the effects of low level long range transport of cadmium, a “multi-hop” metal, which has re volatilized from both local and long range transport sources in the Subarctic and Arctic (Cheng et al., 1993).

The following elements may be enhanced due to EKATI sources; $Al > Ni > Sr > U > Mg >> Pb > Cu > Cr > Co$. The order of the importance is estimated and based on an interpretation of the distributions. Elements with either a non-relationship or a weak relationship with distance from the EKATI mine site include Mn, Zn, As, N, sulphate and pH in snow. These data indicate that most of the elements show a distance relationship that is typical earth crustal road dust-born elements such as aluminum, barium, magnesium, strontium, and others are associated with mineral rich ores such as copper and nickel (usually is associated with cobalt), and uranium (often associated with barium). These latter elements may be elevated due to dust from the mine and roads. It should be stressed the concentrations of most elements in water and tissue are very low, and not associated with toxicity.

When examining the graphs above, it is important to recognize that snow meltwater elemental concentrations are a function of both dust and emissions from local sources, and from long range transport and geogenic inputs, both of which can be substantial in the Subarctic and Arctic environments (Walker et al., 2003; Cheng et al., 1993; Kozac et al., 1990; Gytarsky et al., 1995; Franzen et al., 1994). Although elemental concentrations in water overall were low in comparison to more developed sites in the Arctic, the data show that slightly elevated elemental concentrations in snow water were accompanied by elevated concentrations of the same elements in lichen tissue from paired AQMP sites.



Note: Detection limits for Cadmium are 0.0010: concentrations below detection limits were expressed as half detection limits.

**Aluminum and Nickel (Strong Relationships)
and Cadmium and Zinc (Weak Relationships)
in Lichen Tissue in Relation to Snow Water
near the EKATI Diamond Mine**

Sites AQ-5 and AQ-29, however, were outliers for several elemental concentrations in snow water. These sites are close to the roads leading south of the mine and likely receive road dust prior to the snow sample period. However, the elemental concentrations in lichen tissue from these sites were lower in relation to most of the other AQ sites. The lichens were collected over a larger area than the snow samples and included tissues from areas outside the highest dust depositional boundaries adjacent to roads. The deposition gradient from road edges declines over relatively predictable distances depending on the character of the road surface materials (Viskari et al., 1997; Rogge et al., 1993).

The distributions of elevated concentrations in relation to increases of the same elements in water were bimodal, with two peaks in concentrations in lichen tissues. Figure 3.7-6 is an example; where sulphate concentrations in lichens have two basic patterns; enhancement near the mine site and also, enhancement at distances from the mine site. Cadmium also shows a bimodal distribution.

There is an apparent relationship between concentrations of cobalt, magnesium, nickel and strontium in lichen tissues, where concentrations increased in a non-linear fashion with the concentrations of the same metals in water samples (see Figure 3.7-6 for an example with magnesium). Concentrations of magnesium, strontium and nickel in lichen tissues and water were more linear when the outliers were taken out (Appendix 1). The occurrence of non-linear distributions and outliers in the water and lichen data set are not anomalous; they are mostly an indication of overarching effects of either geogenic or long range transport sources causing dust accumulation, or both.

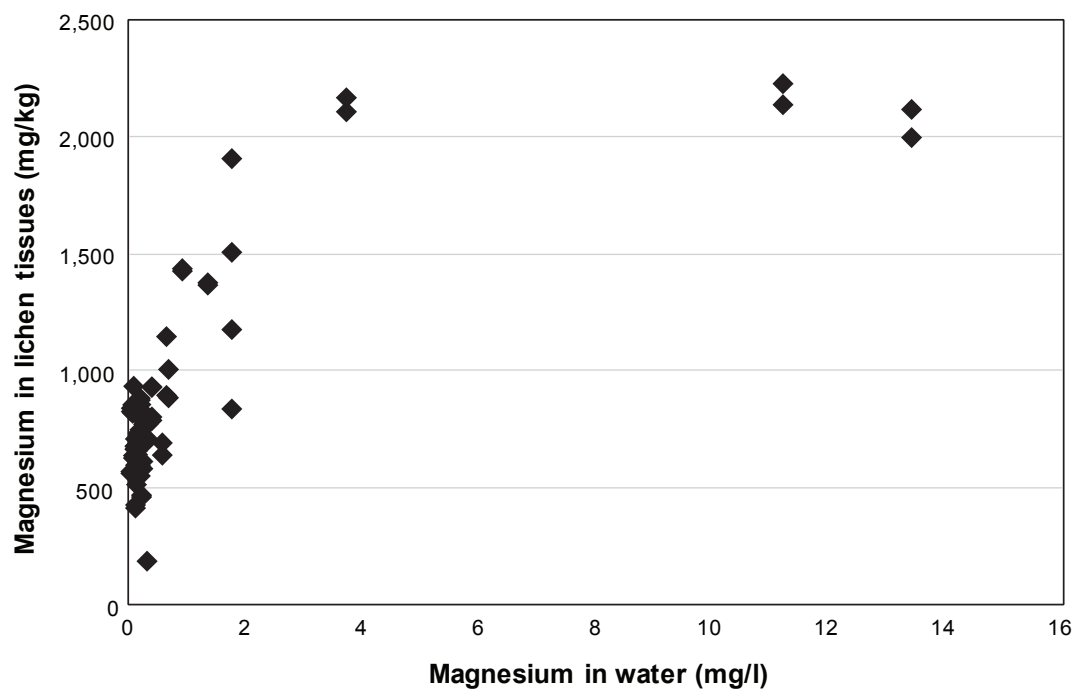
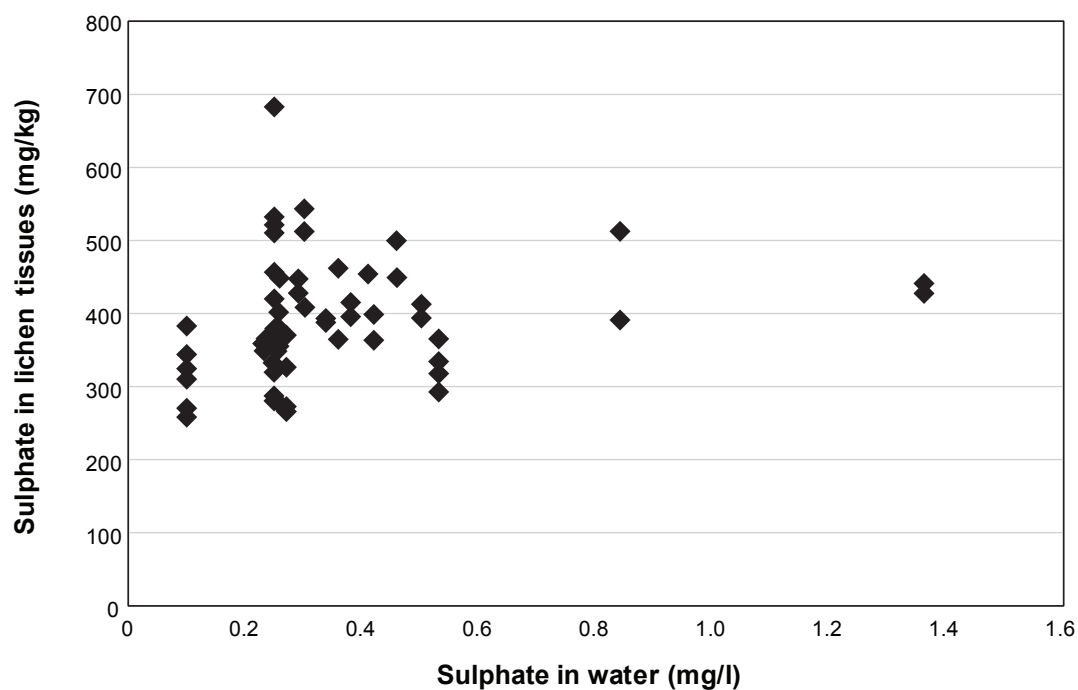
In order to see if EKATI has an influence on local or regional snow water pH the regression of snow water pH against the independent variables sulphate, nitrate, nitrite and total N were performed. For the regression of pH against sulphate (Figure 3.7-7), there is a significant relationship

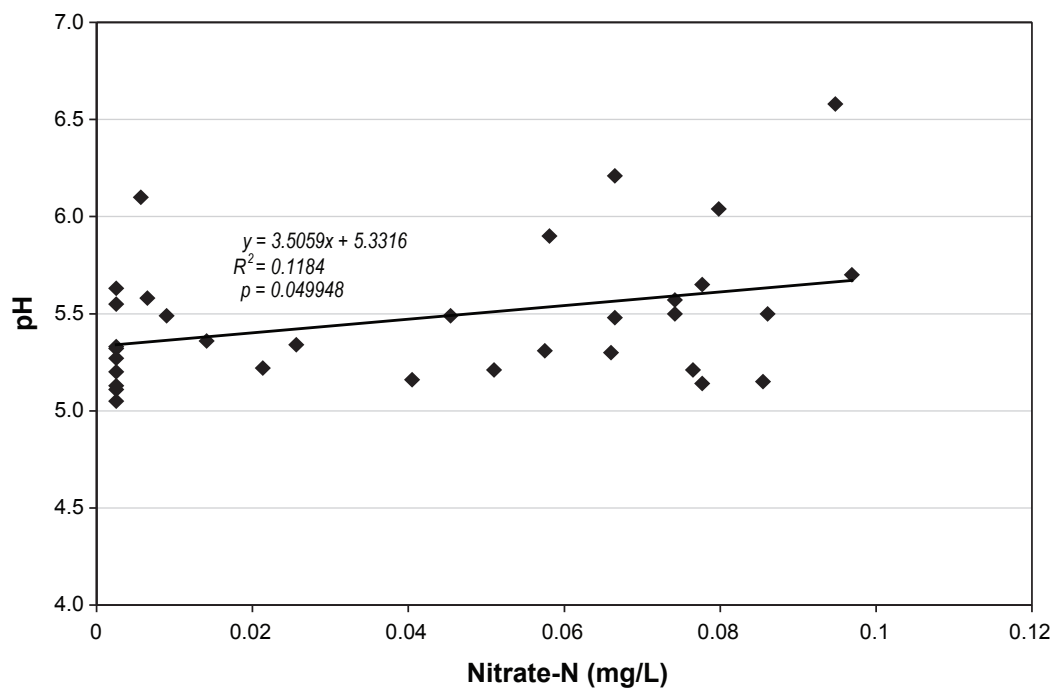
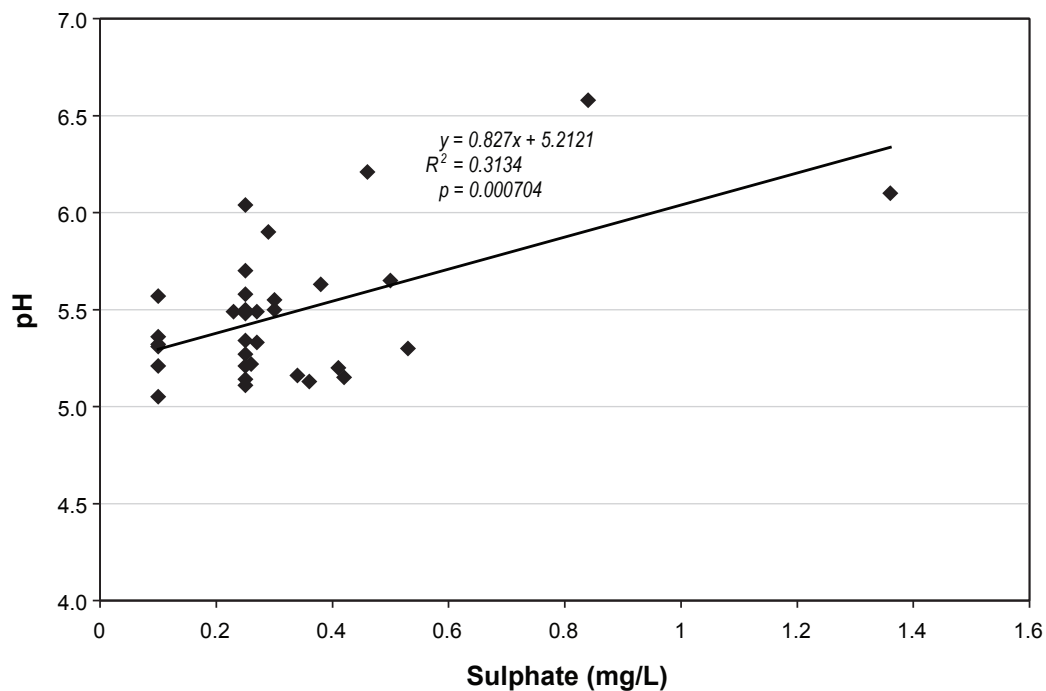
($y = 0.827x + 5.2121$) with $r^2 = 0.3134$, $p < 0.001$. For pH regressed against nitrate (Figure 3.7-7), there is not a statistically significant relationship ($p > 0.01$). Neither the nitrite ($p > 0.01$) nor the Total Kjeldahl Nitrogen vs pH ($p > 0.01$) has a significant regression (Appendix 5). This is an indication of slight, localized sulphate loading, but long range transport of sulphate is also evident.

The concentration of sulphate and total nitrogen in the tissue of lichen as a function of concentrations of snow melt water is shown in Figure 3.7-7. No significant relationships were found between element concentrations in lichen tissues and water snow samples for total nitrogen, when outlier data points were retained. The relationship between lichen N concentrations and snow water is usually very strong and related to both dry and wet deposition, if a significant source of N is nearby (Walker et al., 2003b; Søchting, 1995; Hyvärinen and Crittenden, 1998; Bruteig, 1993). There are no localized trends in acidifying effects of NO_x indicating local sources are not significant.

These data indicate that sulphate particulate has an influence on water pH, but the non-linear distribution in the lichen concentrations indicates that long range transport sources of sulphate particulate are also important. This has been supported in the literature on source apportionment in the subarctic and arctic, as influenced by arctic haze, which was noted in the August of 2008 sample period. Sulphate and metal loading are known to be a significant source of acidification and metals accumulation in the Canadian Arctic (Reimann et al., 1995; Quinn et al., 2007; Cheng et al., 1993).

Nitrification and subsequent acidification is not as pronounced but does occur (Quinn et al., 2007). These data support the conclusion that both small, localized effects from vehicular traffic at EKATI and the effects of long range transport are evident.





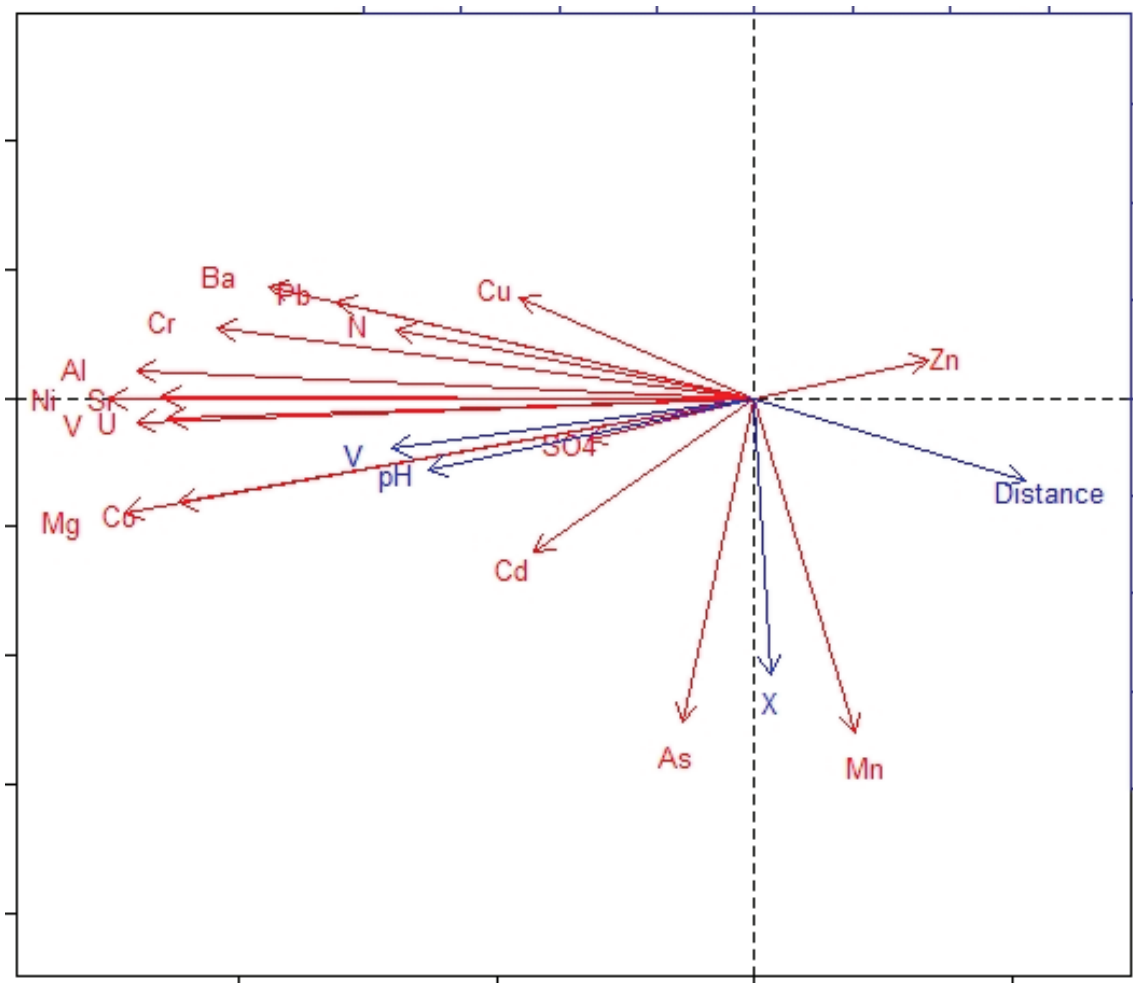
In order to determine if a specific signature for the EKATI mine could be identified from the snow water and lichen data, an RDA (redundancy analysis) was performed (Figure 3.7-8). As *F. cucullata* lichen is responsive to overall long range transport and to localized sources, the patterns in uptake are indicative of source apportionment, providing the sample area is large enough to show where localized effects from EKATI decline and long range or geogenic influences co-occur or exceed localized sources.

The forward selection of the independent variables (the concentrations of elements in the water samples, plus distance from nearest source of metals, pH, days with snow and the geographic coordinates) performed with 99999 permutations kept only four variables in the model, at $\alpha = 0.05$: pH, distance from nearest source, the X geographic coordinate and concentrations of Vanadium (V) in water. According to the results of the RDA, these four variables alone explained 45% of the variation of all elements concentrations in lichens ($R^2_{adj} = 0.45$, $p = 0.00001$). Vanadium concentrations in lichens were also found to show a pattern in relation to the EKATI mine site in the 2005 study, and are evident in Kidd et al. (2003).

In the ordination diagram of the RDA (Figure 3.7-8) the scaling of the ordination was of type 2, which means that the correlations between the variables are approximated by their angles in the diagram (Legendre and Legendre, 1998); in other words, the smaller the angles are, the more correlated the variables are. The blue vectors represent the independent variables selected by forward selection and the red vectors stand for the elements concentrations in lichen tissues.

Results of the RDA suggest that concentrations of V and pH in water samples have links to most element concentrations in lichens tissues. Concentrations of V are positively linked to the concentrations in lichen of SO_4 , Mg, Co, U, V, Sr, Ni, Al, Cr, N, Pb, BA and Cu. The concentrations of all these elements were also negatively associated with the distance from the nearest source, which means that their concentrations increased close to sources of metals in water. The concentrations of zinc in lichen tissues however increased along with an increase in distance from sources; zinc is highly variable in soils and relatively mobile. It usually varies over long distances. Finally, concentrations of As and Mn increased further north of the study area. The concentrations of As and Mn are both associated with Arctic haze (Walker et al., 2003a; Cheng et al., 1993).

In their characterization of Arctic loading from trans-boreal sources, Cheng et al. (1993) indicate that lead, cadmium, sulphate, vanadium and nickel have significant sources with transport to the Canadian Arctic as both winter deposition and summer haze. Also, concentrations of some elements in lichen tissues, which are very sensitive to even minute differences in elemental concentration in dust or gas, are so low as to be reported as half the detection limit from the analysis, and therefore have no link with EKATI as a source. The elements with a decline in concentration over distance in both snow water and lichen are associated with EKATI mine, and appear to have originated mainly from dust, with relatively small emissions of sulphur compounds occurring in the signature. Vanadium in particular, although low in concentration, appears to be a signature substance for EKATI and could possibly be used in ratios to distinguish EKATI from other sources.



Note: Axis 1 expresses 45% and axis 2, 4% of the total variation in element concentrations in lichens.
The blue vectors are independent variables and the red vectors are concentrations in lichen tissues.

4. Conclusions

4. Conclusions

A summary of the key findings associated with each component of the AQMP is provided below.

Air Emissions and Greenhouse Gases

The average annual weight of calculated greenhouse gas emissions from 2006 to 2008 was 198,899 tonnes of CO₂ equivalent. This is 20% less than that estimated during the 2003 to 2005 AQMP (248,245 tonnes of CO₂ equivalent). Consumption of fuel at EKATI continues to be less than observed between 1998 and 2006 due to:

- Energy Smart Program - initiated 2002;
- The No Idle Campaign (including the onsite shuttle service);
- Ongoing shift from the use of surface mobile equipment to the development of underground operations; and
- Ongoing program burning waste oil to heat air for underground workings.

Ambient Air Quality

- HVAS results from 1994 to 2008 indicate that average annual TSP values are consistently below benchmark CAAQO guidelines of 60 µg/m³.

Dustfall

- Between 2006 and 2008 dustfall concentrations were found to be higher at the Fox haul road monitoring stations than at the Misery and Sable roads. These results are reflective of the amount of vehicular activity occurring in these areas over the course of the monitoring period. In most cases, dustfall monitoring results show that fugitive dust levels are elevated immediately adjacent to the road, but fall off quickly with distance. By 1 km from the roads, deposition rates are similar to reference.

Snow Chemistry

- Similar to the results presented in the 2005 AQMP, spatial analysis of snow chemistry data suggests that winter loading of TSS and a number of metals (e.g., Al, Cr) likely associated with fugitive dust and fine particulates are elevated in a zone directly surrounding the mine footprint and concentrations decline rapidly with distance from mining activity. Variables associated with gaseous emissions, blasting and long range transport (e.g., NO₃⁻, NH₃, SO₄²⁻) do not show strong trends with distance from mining activity.
- Most elemental concentrations, even for impacted areas near the EKATI mine site, are below established background concentrations observed at the CAPMoN station Snare Rapids and reported in the literature (as described in Table 3.8-1). The exceptions are for the sampling locations directly near mining activity, and even those concentrations are below those associated with industrial development.

Lichen Indicator Species

- Elemental concentrations in the two indicator lichens collected in the study area indicate that the influence of dust from the mine is confined to a relatively small area around the mine site. From this study it was also evident that volatile elements are dispersed further from the source

than non-volatile elements. Concentrations of elements in lichens collected in 2005 were generally greater than in 2008.

- In contrast most of the non-volatile metals and crustal elements, which tend to decline with distance from the mine site, sulphur and nitrogen concentrations substances have a more generalized distribution. Most of the sources of S and N in the lichen tissues are from depositional materials that can re-volatilize and accumulate in the Arctic from long range transport. Concentrations of S and N in lichen tissue reflect both local sources but also arctic haze and subsequent bioaccumulation.

CALPUFF Air Dispersion Model

- The CALPUFF air dispersion model results compared favourably with observed field data (i.e., snow core chemistry, HVAS, lichen and dustfall). The modelled sulphate deposition contributions from EKATI, Misery, and Diavik are of the same magnitude as background levels beyond 3 to 5 km from the active mining areas. However, the 2008 snow core chemistry and lichen data did not show a trend of decreasing sulphate deposition with distance from the active mining areas. This result indicates that sulphate deposition is likely less than the model predictions and is dominated by background deposition where contributions to sulphate deposition from EKATI, Misery, and Diavik are negligible.

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Appendix 1

BHP Billiton Greenhouse Gas Management Plan

Greenhouse Gas Management Plan

Owner: Environment Advisor - Compliance	Approver: Superintendent - Environment Operations	Issue Number: 2	Creation Date: 17 March 2003
		Document Last Reviewed: 13 Nov 07	Revised: 11 January 2009

Objective

The principal objective of this Greenhouse Gas Management Plan is to identify measures to reduce greenhouse gas (GHG) emissions at the EKATI Diamond Mine. This management plan outlines EKATI's commitment to attain the highest performance in energy and GHG emissions management by developing strategies, identification of energy consumption patterns and GHG sources, monitoring of related activities, setting targets and implementing action plans for improvement.

Scope

This GHG Management Plan documents BHP Billiton Diamond Mine's approach to climate change and outlines strategies for reducing GHG emissions at the EKATI Diamond Mine. As with any other management document, periodic reviews of the plan are necessary. The purposes of these reviews are twofold:

- To confirm continuing compliance with BHP Billiton's Health, Safety, Environment and Community (HSEC) Policy; and
- To allow the plan to be updated in light of operational or technical changes.

Introduction

BHP Billiton Diamonds Inc. is committed to reducing GHG emissions at the EKATI Diamond Mine in accordance with the corporate HSEC Policy.

Definitions

GHG	Greenhouse Gas
HSEC	Health, Safety, Environment and Community
	See BHP Billiton HSEC Toolkit No. 10 Greenhouse Gas Protocol for additional definitions.

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Preparation

Hazards	None
Tools	GHG Database and BHP Billiton HSEC Toolkit No. T10 Greenhouse Protocol
Requirements	None

Elements

1. BACKGROUND

As cited in the 2002 HSEC Report, BHP Billiton has a target for all managed sites with GHG emissions greater than 100,000 tonnes per annum of carbon dioxide equivalent to have energy conservation plans with specific targets and GHG management programs in place by 30 June 2003.

2. INTENT AND SCOPE

This GHG Management Plan outlines the EKATI Diamond Mine's commitment to reduce GHG emissions per unit of production. Since energy management and GHG emissions are closely related, some aspects of energy management have been combined in this GHG Management Plan. Energy management is covered by a separate Energy Smart Program. Due to the dynamic nature of EKATI Diamond Mine this management plan is a living-document and will be updated periodically as business and operational conditions change.

This management plan covers the following aspects:

- Defining GHG strategic management framework;
- Identification of energy intensive activities and GHG emission sources;
- Establishment of GHG emissions monitoring and reporting protocol;
- Setting short-term and long-term targets
- Developing action plans; and
- Performance tracking and review procedures.

This document also makes reference to the BHP Billiton HSEC Guideline: *Energy and Greenhouse*, and its supporting *HSEC Toolkit NoT10: Greenhouse Gas Emissions*.

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3. ENERGY AND GHG MANAGEMENT STRATEGY

The EKATI Diamond Mine considers that efficient use of energy and minimising GHG emissions is a high priority and directly benefits our business performance and BHP Billiton Diamonds Inc. The management team and employees are committed to support and enforce an energy conservation culture in line with Diamonds & Specialty Products and BHP Billiton's overall resource management strategies.

The following management structure encourages involvement by all levels of the operation.

3.1 Roles and Responsibilities

Management:

- Fulfilment of all applicable laws, regulations and requirements on energy efficiency and GHG management and reporting;
- Where feasible, participate in the development of external policies, legislations and regulations pertinent to energy efficiency and GHG emissions reduction;
- Develop and maintain an energy efficiency and GHG awareness program in the workforce;
- Identify energy efficiency improvements and GHG reduction opportunities in discussion sessions with employees and contractors;
- Communicate the company energy policy to all employees and ensure that the employees have adequate training, skills and incentive to participate in the program; and
- Provide the necessary resources such that energy conservation and GHG reduction targets can be achieved.

Employees:

- Participate in discussion sessions with management to identify opportunities for improvement; and
- Implement energy and GHG reduction activities and awareness programs as identified.

Contractors and suppliers:

- Ensure that all goods and services are provided using energy efficient and cost-effective approach.

3.2 Policy and Strategy

The policy and strategy cover all business units and activities at the EKATI Diamond Mine. Energy efficiency has been, and will be included in the decision making process for the acquisition of new equipment. Energy efficiency and GHG targets may be incorporated as Key Performance Indicators in the future.

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The energy saving and GHG emissions reduction activities will be implemented based on the following strategy:

- High priority activities are short-term high impact activities that will achieve quick solution with financial benefits, to be implemented as soon as practicable;
- Medium priority activities are medium-term medium-impact activities that will achieve solutions with negligible financial costs, concrete action plans to be developed and cost estimated in detail; and
- Long term activities will be evaluated at management level in accordance with corporate objectives and investment guidelines.

3.3 Reporting

Progress against energy efficiency and GHG targets are reported to the BHP Billiton 6-monthly HSEC report. Additionally, GHG and energy use is reported to the following external stakeholders:

- Canadian Standards Association Climate Change Services (formerly the Voluntary Challenge and Registry Inc.) - An Action Plan for Reducing Greenhouse Gas Emissions (voluntary);
- Mining Association of Canada - Toward Sustainable Mining Environmental Progress Report, (voluntary);
- Wek'eezhii Land and Water Board - Annual Water Licence/Environmental Agreement Report (mandatory);
- Environment Canada - National Pollution Release Inventory (mandatory); and
- Statistics Canada - GHG Emissions Report (mandatory).

4. ENERGY INTENSIVE ACTIVITIES AND GHG EMISSION SOURCES

4.1 Scope of GHG Inventory - Physical Location & Boundaries

The EKATI Diamond Mine is located approximately 200 km south of the Arctic Circle and 300 km northeast of Yellowknife in the Northwest Territories, Canada. The total claim block consists of 344,000 hectares. The mine site is self contained, with all the amenities of any small community, and it is accessible by air or winter ice road for two months of the year. The mine site produces its own power with seven diesel powered generators.

EKATI is a joint venture of BHP Billiton Diamonds Inc. (80%) and geologists Charles Fipke and Dr. Stewart Blusson (10% each). BHP Billiton has 100% operational control; emissions are attributed entirely to this company.

The majority of freight is transported to the mine site by tractor trailer in the winter on the ice road, and most perishable food items are flown in by Hercules Aircraft from Yellowknife.

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As the site is remote, personnel are flown to work on chartered aircraft. Helicopters are used in the summer months to provide access to remote portions of the claim block for the purposes of conducting environmental monitoring.

Based on BHP Billiton corporate guidance, the operational boundaries of the inventory have been set to include all activities inside the physical boundaries of the claim block, irrespective of whether the activities are undertaken by BHP Billiton personnel or contractors.

The following activities are excluded from the inventory calculation:

- Transportation of materials by contractors to site (e.g. winter road operations); and
- Transportation of personnel by contractors to site (e.g. personnel flying on chartered aircraft).

It is understood that emissions from these activities are indirect, and may be accounted for in the inventories of the trucking or airline companies.

Energy use and fuel consumption are recorded on a daily basis in the site databases (Power Plant Reporting System and EKATI Petroleum Management (MidCom)). GHG emissions are calculated on a monthly basis in the site GHG database, and reported biannually to BHP Billiton Corporate through the company HSEC Reporting system, as well as to other external stakeholders as noted above.

Fuel consumption and associated GHG emissions for Fiscal Year 2008 (July 1, 2007 - June 30, 2008) are highlighted in Table 1.

Table 1. Fuel consumption and greenhouse gas emissions (FY2008)

Activity	Fuel Type	Fuel Consumption (litres)	GHG Emissions (tCO ₂ e)	As % of Total
Power Plant ¹	Diesel	33,779,585	93,162	47.7%
Motive Equipment	Diesel	20,542,405	56,655	29.0%
Heating of Buildings	Diesel	11,179,178	30,832	15.8%
Other Non-Motive ²	Diesel	4,231,576	11,670	6.0%
Heating of Buildings	Used Oil	370,395	1,148	0.6%
Helicopter Travel	Jet A-1	70,824	186	0.1%
Motive Equipment	Gasoline ³	3,485	8	0.0%
Blasting	ANFO/Emulsion	8,003 (tonnes)	1,513	0.8%
TOTAL			195,174	100.00

Note: ¹ Power is generated onsite by seven diesel generators.

² Other non-motive activities include incinerators, mobile heaters, crushers, compressors, hot boxes, dewatering pumps and other pumps.

³ Gasoline is reported in calendar year.

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The majority of GHG emissions at the EKATI Diamond Mine are from combustion of fossil fuels. As shown in Table 1, diesel fuel is the main source of GHG emissions; however, blasting and the combustion of biomass also contribute to the emissions level.

Fuel consumption is segregated into six categories: power generation, motive equipment (diesel and gasoline), heating of buildings (diesel and used oil), other non-motive, helicopter travel and blasting.

On an activity level, the majority of energy during FY2008 was consumed as follows:

- Power Plant 47.7%
- Motive Equipment 29.0%
- Heating 15.8%

EKATI's energy consumption amounts to 100% of the Diamonds and Specialty Products total of 2.7 Petajoules (PJ) and 0.89% of the BHP Billiton total of 305 PJ. The GHG emissions equate to 100% of the Diamonds and Specialty Products total of 200,000 tCO₂e, and 0.37% of BHP Billiton total of 53,800,000 tCO₂e in 2008.

4.2 Base Year Calculations

Previous reports have identified FY2000 as the base year for GHG target setting as this was EKATI's first full year of Process Plant operation. However, during FY2000 operations only consisted of one open pit (Panda Pit) with a short haul distance (~5 km) to the Processing Plant.

A more representative year from which to establish baseline GHG levels would be FY2002. During this period there were four active pits (Misery, Koala, Koala North and Panda Pit); additionally, hauling of ore from Misery Pit was occurring (~30km).

During FY2007 EKATI maintained two open pit operations (Fox and Beartooth Pit) and one underground operation (Panda Pit). This was in addition to the construction of Koala North Underground, hauling of stockpiled ore from the Misery Pit and hauling of ore from Fox Pit (~10km) for processing. The magnitude of EKATI's 2007 operations was not comparable to the 2000 operations.

The comparable level of activity between FY2002 and FY2007 suggests that using FY2002 as the base year is more representative of level of effort to achieve intensity targets, and therefore the base year for future comparison has been changed to FY2002. Table 2 presents the baseline GHG emission data.

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Table 2. GHG Emissions by activity in base year (FY2002)

Activity	CO ₂	CH ₄	N ₂ O	Total GHG Emissions (tCO ₂ e)
Motive & Non-Motive Equipment	139,069	128	1,295	140,492
Power & Heating	65,656	61	611	66,328
Blasting Activities	3,851	-	-	3,851
Jet A-1	946	1	26	973
Jet B	108	2	3	113
Total Emissions	209,630	192	1,936	211,758
Ore Processed (dry tonnes)				3,392,041
Intensity Factor	-	-	-	0.062

Note: Due to rounding of individual gas values the sum of the GHG may not add exactly. Values in the totals columns are, however, accurate.

Following guidance of the World Business Council for Sustainable Development/World Resources Institute GHG Protocol, the following cases shall trigger recalculation of base year emissions:

- Structural changes in the reporting organization that have a significant impact on the company's base year emissions. A structural change involves the transfer of ownership or control of emissions-generating activities or operations from one company to another. While a single structural change might not have a significant impact on the base year emissions, the cumulative effect of a number of minor structural changes can result in a significant impact. Structural changes include:
 - Mergers, acquisitions, and divestments; and
 - Outsourcing and insourcing of emitting activities.
- Changes in calculation methodology or improvements in the accuracy of emission factors or activity data that result in a significant impact on the base year emissions data; and
- Discovery of significant errors, or a number of cumulative errors, that are collectively significant.

4.3 Business as Usual Projections

On a business as usual basis, energy consumption at the EKATI Diamond Mine is expected to decrease on average 5.4% per annum from FY2009 to FY2013 by a total of 16%.

On an energy per unit production (energy intensity) level, EKATI estimates that energy intensity will decrease on average 5.4% per annum during FY2009 – FY2013 by a total of 16.6%.

The decreasing trends reflect the mine plan, such as the move away from surface mining toward underground mining, using less surface equipment. Table 3 quantifies these trends.

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Table 3. Business as Usual Diesel Fuel Consumption Predictions 2009 - 2013 (in Litres)

	FY2009 Est.	FY2010 Est.	FY2011 Est.	FY2012 Est.	FY2013 Est.
Motive Diesel	15,739,330	12,692,522	11,546,137	11,284,404	11,028,442
Powerhouse	37,161,076	37,161,076	37,161,076	37,161,076	37,161,076
Diesel Heating	9,837,955	9,072,601	8,958,400	7,689,058	4,590,264
Total Litres consumed	62,738,361	58,926,199	57,665,613	56,134,538	52,779,782
Annual Rate of Change	-10.0%	-6.1%	-2.1%	-2.7%	-6.0%
Ore Processed (dry tonnes)	4,340,000	4,348,000	4,339,000	4,355,000	4,353,000
Intensity (Litres per dry tonne)	14.5	13.6	13.3	12.9	12.1
Annual Rate of Change	-9.4%	-6.2%	-2.2%	-3.0%	-6.2%

Note: Data obtained from Long Range Planning & Projects Department and is only based on diesel consumption.

EKATI expects that GHG emissions will decrease on average 5.6% per annum from FY2009 to FY2013 by a total of 17% on a business as usual basis.

On a GHG emissions per unit of production level (GHG intensity level), EKATI estimates that intensity will decrease at 5.9% per annum during FY2009 – FY2013 by a total of 18% on a business as usual basis.

The decreasing trends reflect the mine plan, such as the move away from surface mining toward underground mining, using less surface equipment. Table 4 quantifies these trends.

Table 4. Business as Usual GHG Emissions Predictions (2009 - 2013)

	FY2009 Est.	FY2010 Est.	FY2011 Est.	FY2012 Est.	FY2013 Est.
Diesel GHG Emissions (tCO ₂ e)	173,029	162,515	159,038	154,816	145,563
Blasting GHG Emissions (tCO ₂ e)	1,777	1,201	946	71	66
Total GHG Emissions (tCO₂e)	174,806	163,716	159,984	154,887	145,629
Annual rate of change	-10.4%	-6.3%	-2.3%	-3.2%	-6.0%
Ore Processed (dry tonnes)	4,340,000	4,348,000	4,339,000	4,355,000	4,353,000
Intensity Factor (CO ₂ e per dry tonne)	0.040	0.037	0.037	0.036	0.033
Annual rate of change	-11.1%	-7.5%	0%	-2.7%	-8.3%

Note: ¹ Data obtained from Long Range Planning & Projects Department and is only based on diesel consumption

² Detailed source data is available in Table 6.

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5. MONITORING AND REPORTING

5.1 Data Quality and Uncertainty

The energy consumption figures are currently monitored on a continuous basis using the Mid-Com I-button system, and are reconciled monthly to tank inventories. EKATI considers that the energy data are accurate to +/- 5%. This level of accuracy is due to the current method of tracking fuel consumption onsite.

The GHG emissions estimates were determined directly based on emission factors associated with each type of energy used from Canada's Greenhouse Gas Inventory Report 1990-2005, Greenhouse Gas Division, Environment Canada, April 2007 have been used to calculate this inventory: http://www.ec.gc.ca/pdb/ghg/inventory_report/2005_report/2005_report_e.pdf

Quantity of gasoline used is calculated by the number of drums of gasoline released from the warehouse in a given month. While this calculation may not be entirely representative of the actual gasoline burned in a month, it is considered to be representative of gasoline consumption averaged over the reporting period. The small amount of gasoline used on site does not justify further efforts for accurate calculations, and the difference in records is not considered to be material.

The effects of blasting are calculated using activity data from the Survey Department (kg of Ammonium Nitrate/Fuel Oil mixture (ANFO) and emulsion used per month) and multiplying by an emission factor as described in below.

Waste incineration is calculated using an estimate of garbage generated per person per day. This estimate was derived from a study conducted at EKATI in 2004, in which amount of garbage burned in the incinerator was weighed over the period of a week, and was divided by the number of people staying in camp at that time. The factor generated was 1.86 kg of garbage per person per day. Presently, tonnes of garbage incinerated per month is estimated based on the average number of residents in camp per month, multiplied by the factor of 1.86 kg/person/day. This information is then used as described below, to calculate greenhouse gases emitted due to biomass combustion.

Freon is used in vehicle air conditioners and in refrigerators around the site. Vehicular Freon used is calculated based on sales records of Freon (HFC-134a) bottles from Kingland Ford to BHP Billiton. Each bottle weighs 13.6 kg (30 lbs). The number of bottles used over the given time period is multiplied by the weight of the bottle, and reported in tonnes. This is considered to be a very conservative estimate of actual HFC-134a use, since the calculation accounts for the weight of the steel bottle as well as the product.

Additional hydrofluorocarbon releases are estimated based on maintenance records of the Heating, Air Conditioning, Ventilation and Cooling (HVAC) technician who maintains all HVAC related equipment. Because the refrigeration systems are intended to be closed loop systems, the addition of product to a unit can be used to estimate loss of the product over time. While it is not known when exactly the product was lost, the quantities released to the environment are considered to be accurate. The maintenance of these records is a federal requirement under the federal Halocarbon

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Regulations, and paper records are kept by the Maintenance Team Leaders. Once the type and quantity of halocarbons released has been determined, data is treated as described below to determine quantity of greenhouse gases generated.

The following are methods used to calculate greenhouse gas emissions:

Diesel

CO_2 (tonnes) = litres of diesel * 0.00273 tonnes/litre

CH_4 (tonnes CO_2e) = litres of diesel * 0.00000012 tonnes/litre * conversion factor of 21

N_2O (tonnes CO_2e) = litres of diesel * 0.000000082 tonnes/litres * conversion factor of 310

Jet A1

CO_2 (tonnes) = litres of Jet A1 * 0.00255 tonnes/litre.

CH_4 (tonnes CO_2e) = litres of Jet A1 * 0.00000008 tonnes/litre * conversion factor of 21

N_2O (tonnes CO_2e) = litres of Jet A1 * 0.00000023 tonnes/litres * conversion factor of 310.

Jet B

CO_2 (tonnes) = litres of Jet B * 0.00233 tonnes/litre.

CH_4 (tonnes CO_2e) = litres of Jet B * 0.0000022 tonnes/litre * conversion factor of 21

N_2O (tonnes CO_2e) = litres of Jet B * 0.00000023 tonnes/litres * conversion factor of 310.

Used Oil

CO_2 (tonnes) = litres of used oil * 0.00308 tonnes/litre

CH_4 (tonnes CO_2e) = litres of used oil * 0.000000034 tonnes/litre * conversion factor of 21.

N_2O (tonnes CO_2e) = litres of used oil * 0.000000064 tonnes/litre * conversion factor of 310.

Gasoline

CO_2 (tonnes) = litres of Gasoline * 0.00236 tonnes/litre.

CH_4 (tonnes CO_2e) = litres of Gasoline * 0.0000013 tonnes/litre * conversion factor of 21

N_2O (tonnes CO_2e) = litres of Gasoline * 0.000000066 tonnes/litres * conversion factor of 310.

Blasting

CO_2 (tonnes) = tonne ANFO x 0.189

CO_2 (tonnes) = tonne emulsion x 0.189

Biomass

The following method is used to calculate CO_2 from waste incineration (biomass):

Assume waste burned is 90% biomass, 10% plastic

C from incineration food waste at 40% dry matter & 38% carbon content

CO_2 from incineration food waste (tonnes C * 44/12)

C from plastics at 100% dry matter & 75% carbon content

CO_2 from incineration plastic waste (tonnes C * 44/12)

CH_4 is waste incinerated (Gg) x 6 Emissions Factor x 10^{-6}

N_2O is waste incinerated (Gg) x 50 Emissions Factor x 10^{-6}

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HFCs

Mass of HFC-125 (tonnes) * Global Warming Potential of 2800

Mass of HFC-134a (tonnes) * Global Warming Potential of 1300

Mass of HFC-143a (tonnes) * Global Warming Potential of 3800

5.2 Data Management and Reporting

The fuel consumption and GHG emissions data are currently accessible from the GHG database.

EKATI Diamond Mine considers the present data management and reporting procedure adequate to implement the action plans and monitor target progress. The energy and GHG data can be audited/verified by independent organizations. An independent verification audit was last conducted in April, 2007.

6. TARGETS

6.1 Energy Target

A target was previously set for a 5% reduction in energy usage by FY2007, using FY2002 as the base year.

As a corporation, BHP Billiton has adopted the following targets for GHG reduction:

- A 13% reduction in carbon based energy use per unit of production by 30 June 2012, using FY2007 as the base year.

Additionally, targets have been adopted by Customer Service Groups (CSGs). The EKATI Diamond Mine is in the Diamonds and Specialty Products CSG, which has adopted the following target:

- A 6% reduction in energy use from FY2006 – 2012.

6.2 GHG Emissions Target

A target was previously set for a 5% reduction in emissions per unit of production by FY2007, using FY2002 as the base year.

As a corporation, BHP Billiton has adopted the following targets for GHG reduction:

- A 6% reduction in GHG emissions per unit of production by 30 June 2012, using FY2006 as the base year.

Additionally, targets have been adopted by Customer Service Groups (CSG). The EKATI Diamond Mine is in the Diamonds and Specialty Products CSG, which has adopted the following target:

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- A 3% reduction in GHG emissions from FY2006 to FY2012.

As a site, the EKATI Diamond Mine is committed to achieving the targets outlined in the Energy Smart Program each year. Additionally, EKATI targets to achieve a 'Silver Level Champion Reporter' status or higher with the CSA Climate Change GHG Registry.

6.3 Confidence Level

BHP Billiton Diamonds Inc. is confident that targets will be met by FY2012 due to actions such as the No Idle Campaign, and the decrease in fleet size of surface equipment as the mine moves from surface mining towards underground mining which requires less trucking to move materials. Efforts are being made to rationalize resources across site, and to use less equipment and buildings by being more efficient with those we are using. Examples of this rationalization is described below.

7. ACTION PLANS

Potential reduction activities and/or projects

- Windfarm Feasibility Study: EKATI is registered with the federal government of Canada as a proposed wind farm site. We have applied for funding to purchase 6 new Enercon, one megawatt (MW) wind turbines. These turbines would produce six MW of power.
- Commissioning of Koala Fresh Air Raise #2 Mine Air Heating System: A second piping system was initiated to use waste heat from the Powerhouse to preheat underground air, decreasing the use of diesel for this purpose.
- No Idle Campaign: Based on past year's successes, the No Idle Campaign will continue. Reductions in this program will be preventative – it is not anticipated alone to have quantifiable reductions in fuel use or greenhouse gases as it is a program which is ingrained into the culture of the site. Reduction estimate in Table 7 is based on past measured performance from the first year of the program.
- Genset #7 Project: New generator to be installed in the Powerhouse has an electrical engine management system (fuel injection), which will use 5-7% less fuel than the existing generators. While this activity will not result in a net reduction in emissions, it will mitigate the effect of adding another generator to the Powerhouse.
- Evaluation of Feeder Loads: A comparison of electrical usage by substation based on feeder meters, to determine which feeders consume the most electricity and to identify potential for reductions in use.
- Electric Drive Motor Audit: Implementation of an efficiency audit on electrical drive motors in the plant to determine the most effective and efficient means of powering our equipment
- Fuel Additives Research: Research underway into additives to diesel in the Powerhouse which could contribute to more efficient operations and fuel economy.

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Table 5 provides a quantification of the potential impacts from these projects.

Table 5. Potential emissions reductions by project

	Diesel Savings (L)	GHG Savings (tCO ₂ e)
Direct Emission Reductions		
Windfarm	4,700,000	12,962
Heat Recovery KFAR#2	800,000	2,206
No Idle Campaign	291,500	804
Indirect Energy Emission Reductions		
Genset #7 Project	~278,000	767
Evaluation of Feeder Loads	**	**
Electric Drive Motors Audit	**	**
Fuel Additive Research	**	**
Total Potential Savings	6,069,500	16,739

Note: ** Potential reductions from research and studies not yet conducted cannot be estimated because the purpose of the exercise is to determine this data.

8. PERFORMANCE TRACKING

A target was previously set for a 5% reduction in energy usage by FY2007, using FY2002 as the base year. Over that time period, the reduction in energy usage at EKATI was 10% for diesel fuel, which comprises the majority of energy usage at site.

For BHP Billiton as a corporation, the present target is a 13 % reduction in carbon based energy use per unit of production from FY2007 to FY2012. Using the Business As Usual forecast, EKATI is projecting a 15% decrease in energy intensity over this time frame. This estimate may not be representative of actual predicted reductions due to an absence of forecast values for other non-motive activities, Jet A fuel, gasoline and used oil combustion. It is anticipated that these parameters will be included in the next forecast. Comparing FY2008 to FY2006, EKATI is presently achieving this target with an 8% reduction in carbon based energy intensity over that period.

Table 6 presents historical and business as usual estimated energy usage and Table 7 illustrates GHG emissions from FY2002 to FY2012.

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Table 6. Energy consumption FY2002 – FY2013

Activity	FY2002	FY2003	FY2004	FY2005	FY2006	FY2007	FY2008	FY2009 (est)	FY2010 (est)	FY2011 (est)	FY2012 (est)	FY2013 (est)
Motive Equipment	38,833,570	39,739,780	40,309,753	53,930,603	36,608,693	26,831,180	20,542,405	15,739,330	12,692,522	11,546,137	11,284,404	11,028,442
Heating of Buildings	4,635,657	1,273,671	2,587,660	5,869,532	6,871,329	7,384,674	11,179,178	9,837,955	9,072,601	8,958,400	7,689,058	4,590,264
Power Plant	19,414,280	20,753,581	22,542,396	27,187,238	29,190,462	31,371,141	33,779,585	37,161,076	37,161,076	37,161,076	37,161,076	37,161,076
Other Non Motive Activities	12,107,310	12,011,689	12,654,726	2,790,976	2,307,437	1,770,963	4,231,576	-	-	-	-	-
Total Diesel Consumption	74,990,817	73,778,721	78,094,535	89,778,349	74,977,921	67,357,958	69,732,744	62,738,361	58,926,199	57,665,613	56,134,538	52,779,782
Blasting ANFO & Emulsion (tonnes)	20,377	22,016	18,206	24,085	13,149	9,395	8,003	9,404	6,354	5,003	373	349
Jet A Fuel	370,888	-	9,662	64,867	84,783	87,460	70,824	-	-	-	-	-
Jet B Fuel	46,274	69,908	41,161	-	-	-	-	-	-	-	-	-
Gasoline	-	-	5,535	6,560	7,995	3,075	3,485	-	-	-	-	-
Used Oil	-	-	400,000	17,818	584,099	780,642	370,395	-	-	-	-	-
Total Carbon Based Energy Use (no units)	75,428,356	73,870,645	78,569,099	89,891,679	75,667,947	68,238,530	70,185,451	62,747,765	58,932,553	57,670,616	56,134,911	52,780,131
Ore Processed (dry tonnes)	3,392,041	4,322,512	4,448,319	4,573,889	4,312,793	4,526,100	4,355,034	4,340,000	4,348,000	4,339,000	4,355,000	4,353,000
Intensity (carbon based energy per unit of production)	22.2	17.1	17.7	19.7	17.5	15.1	16.1	14.5	13.6	13.3	12.9	12.1

Note: ¹ All values in litres unless otherwise noted.

² Gasoline reliably tracked as of 2004. Gasoline is presented in calendar year.

Previously, BHP Billiton's corporate GHG emission reduction target was 5% per unit of production from FY2002 to FY2007. This target was exceeded and realized a reduction of 32.7%.

Presently, the target is a 6% reduction in GHG emissions per unit of production from FY2006 to FY2012. Using the Business As Usual forecast, EKATI is projecting a 27% decrease in intensity over this time frame. However, this estimate may not be representative of actual predicted reductions due to an absence of forecast values for other non-motive activities, Jet A fuel, gasoline and used oil combustion. It is anticipated that these parameters will be included in the next forecast. Comparing FY2008 to FY2006, EKATI is presently meeting this target with an 8.2% reduction in intensity over the period.

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Table 7. Total emissions FY2002 – FY2013 (tCO₂e)

Activity	FY2002	FY2003	FY2004	FY2005	FY2006	FY2007	FY2008	FY2009 (est)	FY2010 (est)	FY2011 (est)	FY2012 (est)	FY2013 (est)
Motive Equipment	107,101	109,600	111,172	148,737	100,965	73,999	56,655	43,408	35,005	31,844	31,122	30,416
Heating of Buildings	12,785	3,513	7,137	16,188	18,951	20,366	30,832	27,132	25,022	24,707	21,206	12,660
Power Plant	53,543	57,237	62,171	74,981	80,506	86,520	93,162	102,488	102,488	102,488	102,488	102,488
Other Non-Motive Activities	33,391	33,128	34,901	7,697	6,364	4,884	11,670	-	-	-	-	-
Total Diesel Emissions (tCO₂e)	206,820	203,477	215,380	247,603	206,785	185,769	192,319	173,029	162,515	159,038	154,816	145,563
Blasting Activities	3,851	4,161	3,441	4,552	2,485	1,776	1,513	1,777	1,201	946	70	66
Jet A Fuel	973	0	25	170	222	229	186	-	-	-	-	-
Jet B Fuel	113	171	101	0	0	0	0	-	-	-	-	-
Gasoline	0	0	13	16	19	7	8	-	-	-	-	-
Used Oil	N/A	N/A	1,240	55	1,811	2,420	1,148	-	-	-	-	-
Ore Processed (dry tonnes)	3,392,041	4,322,512	4,448,319	4,573,889	4,312,793	4,526,100	4,355,034	4,340,000	4,348,000	4,339,000	4,355,000	4,353,000
Total Emissions (tCO₂e)	211,758	207,809	220,201	252,396	211,322	190,202	195,174	174,806	163,716	159,984	154,886	145,629
Intensity Factor	0.062	0.048	0.050	0.055	0.049	0.042	0.045	0.040	0.037	0.037	0.036	0.033

Note: ¹ N/A (Not Available) – Used Oil was not burned until FY2004.

² Gasoline usage was reliably tracked as of 2004. Numbers are from calendar year.

³ Due to rounding of individual gas values the sum of the GHG may not add exactly. Values in the totals columns are, however, accurate.

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The corporate and EKATI goal of a 5% reduction in GHG emissions between FY2002 – FY2007 was exceeded, with a reduction of 8% over the stated period.

Table 8: Biomass combustion by year

	FY2002	FY2003	FY2004	FY2005	FY2006	FY2007	FY2008
Biomass Burned (tonnes)	417	442	436	498	489	476	437
Total Emissions (tCO ₂ e)	330	350	345	395	388	377	346

Table 9: HFC releases by year

		Tonnes	tCO ₂ e
Calendar Year 2008	HFC-125	0.002	6.7
	HFC-134a	0.163	212
	HFC-143a	0.003	10.7
TOTAL			229
Calendar Year 2007	HFC-125	0.0001	2.9
	HFC-134a	0.218	283
	HFC-143a	0.001	4.6
TOTAL			291
Calendar Year 2006	HFC-125	0.011	3.1
	HFC-134a	0.3	390
	HFC-143a	0.001	4.9
TOTAL			398
Calendar Year 2005	HFC-134a	0.283	368
Calendar Year 2004	HFC-125	0.002	5.6
	HFC-134a	0.285	371
	HFC-143a	0.003	9.9
TOTAL			387

Note: HFCs are reported externally in calendar year, and are therefore presented as such here.

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Documents and Records

- CSA Climate Change (formerly VCR Inc.'s) Registration Guide
- CSA Climate Change (formerly VCR Inc.'s) Champion Level Reporting Checklist
- CSA Climate Change (formerly VCR Inc.'s) Challenge Registry Transmittal Form
- Power Plant Reporting System
- Ekati Petroleum Management (Mid:Com)
- GHG Database

Resources

- CSA Climate Change (formerly VCR Inc.'s) Standardized Reporting Template
- CSA Climate Change (formerly VCR Inc.'s) Energy Management Action Plan Guidelines
- CSA Climate Change (formerly VCR Inc.'s) Energy Management Action Plan Template
- Natural Resources Canada's (NRCan) Industrial Energy Innovators Energy Efficiency Report Template
- The Greenhouse Gas Protocol (World Business Council for Sustainable Development and the World Resources Institute)
- HSEC Toolkit No. T10 GHG Emissions
- BHP Billiton HSEC Guideline No. G17 Energy and Greenhouse
- BHP Billiton HSEC Guideline – Energy and Greenhouse Gas Management Plan Template
- Greenhouse Gas Division, Environment Canada, April 2007:
www.ec.gc.ca/pdb/ghg/inventory_report/2005_report/2005_report_e.pdf

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Appendix 2

High Volume Air Sampler Standard Operating Procedure (ENVR-SOP-AIR-01)

**bhpbilliton****ENVR-SOP-AIR-01****High Volume Air Sampler Operation****Owner:** Environmental Compliance Team Leader**Approver:** Chief Environmental Officer**Issue Number:** 1**Creation Date:** 25 November 2002**Revision Date:** 8 May 2007

Objective

The purpose of this procedure is to explain the process of HiVol TSP sampler operation to all involved BHP Billiton Diamonds Inc. employees and contractors to ensure that samples are collected in a consistent manner in accordance with the EKATI Diamond Mine Air Quality Program.

Scope

This procedure applies to Technicians and Summer Students of the Environment Department required to operate the two HiVol TSP samplers located on the roof of the Grizzly Lake Pumphouse and east of the LLCF at Cell B at the base of the meteorology station respectively. Sampling takes place every 6 days from approx. May to Oct., depending on the weather conditions. Sampling involves preparation, loading and starting up the samplers, retrieving filters after 24 hours, lab procedures and data entry.

Introduction

EKAT Diamond Mine established an air quality management and monitoring plan to monitor possible effects of emissions and fugitive dust to soil, water, vegetation, animals and worker health and safety. The monitoring plan consists of four (4) elements;

- 1) mass balance emission calculations.
- 2) high volume air sampling.
- 3) snow surveys and.
- 4) vegetation studies.

This procedure will focus on the operation of the High Volume air samplers.

Definitions

HiVol TSP sampler High Volume Total Suspended Particle (Air) Sampler, namely the Tisch Environmental Model TE-5170 Series equipped with a mass flow controller. The equipment functions by drawing a known volume of air through a pre-weighed rectangular glass fiber filter at a known flow rate for a 24-hour period. Samples are weighed after the 24-hour period and the concentration of TSP determined gravimetrically. The sampler is operated every six days to avoid sampling bias.

Filter Binderless glass fiber filters measuring 20.0 by 25.4 cm (Graseby Model # G810)

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Filter Paper Cartridge

The Filter Paper Cartridge provides a rigid frame for the filter, as well, the removable cover protects the filter from contamination during transport.

Preparation

Hazards

- Working on roof tops, snow and ice may be slippery.
- Sampler shelter doors or roof may slam in wind and may pinch fingers/hands.
- Very high windchills may be encountered.
- Difficult terrain walking up tundra to Cell B station TSP-3.

Tools

- 2 Filter Paper Cartridges loaded with prepared filters
- Clipboard
- Pencil
- 2 Data Sheets
- 2 Circular charts
- Spare flow recorder pens
- Spare timer stops
- Screwdriver or multitool
- Watch
- PPE

Requirements

- Sound knowledge and familiarity with the sampling procedure
- Driver's Licence Class 2
- Basic understanding of the science and math involved
- Attention to detail
- No fear of heights, to a smaller extent

Tasks

**1.
Equipment
Preparation**

- Filters used for the collection of TSP are batch prepared and stored individually in sequentially numbered envelopes.
- Filters are heated in a Fisher Scientific 737F Isotemp drying oven at 105°C for 24 hours. The filters are then

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transferred to a Plas Labs #863-CG dessicator and cooled to room temperature. The filters are then weighed individually using a Mettler Toledo AG204 analytical balance and placed into manila envelopes. The weight of the filter to four decimal places is recorded on the envelope. The filters are stored and used as required. Filters must never be touched with bare hands, only with tweezers and must be treated quite carefully.

- Pre-weighed filters are then positioned on the Graseby G3000 Filter Paper Cartridge, rougher side facing up, and secured hand-tight, knurled part of the retaining nut facing upwards. The filters must not be damaged, even the slightest rip or hole make them useless and a new filter must be installed. The cover is snapped on to prevent damage and contamination during transport.
- Blank data sheets are found in Section 7 of the High Volume Air Sampling binder. Two are required for each sampling round, one for each location. Filter number and filter weight as indicated on the envelope are entered on the data sheets as they are placed into the cartridge. Even numbered filters go to Grizzly Lake, TSP-2, odd numbered filters go to Cell B, TSP-3. Destination and sampling personnel must be entered on the data sheet. It is important that the next brush change and calibration due at field at the top of the data sheet is filled in. The number may be taken from the previous data sheet or the calibration sheets in section 4 and 5 in the HiVol binder. This allows instant recognition of the need to service and calibrate the sampler motors.
- The sampling must take place every 6 days during the snow free season. The sampling schedule calendar should be consulted to ensure proper timing. During periods of possible heavy snowfall the sampling should be suspended to avoid sampler motor damage.
- Sampling is generally started at TSP-2 on top of the Grizzly Lake pumphouse. Upon arrival the sampler is inspected for damages visually, the motor is turned on manually without a filter cartridge loaded for 2 to 5 minutes to warm it up and check for proper function. The On/Off switch is reached by opening the main housing door, then opening the mechanical timer housing. The switch is located at the 6 o'clock position

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2. Starting the Sampling

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below the timer disk and is moved right/left to switch On/Off.

- After the warm-up period the motor is shut off, and the filter cartridge placed and secured to the Graseby G10470 Filter Holder, located on top of the sampler underneath the tip-up roof. A chain and S-hook are provided to secure the roof in the open (and closed) position while fastening the cartridge using the four plastic wing nuts. These should be evenly and only finger-tight tightened. It is crucial that the filter cartridge cover is removed before closing the roof and securing it with the S-hook. The removed cover is brought back to the office.
- A TE-106 circular chart is labeled with location, TSP-2 or 3 and the date and inserted into the TE-5009 continuous flow recorder. The chart will fit two ways and care must be taken to insert it so that the pen is at the correct time setting, am or pm. The chart has to be placed underneath the two small metal retainers. The pen should be tested and replaced if necessary. It is then lowered onto the chart by moving the lifter arm. The pen should now sit at the correct present time, if not the chart may be turned for adjustments by inserting a screwdriver into the slot of the axis. The recorder is not yet closed.
- The TE-5007 Flow Controller/7-Day Mechanical timer is checked and set to the correct present time, as displayed by the end of the indicator hand. To correct it, it may be manually turned only in the direction indicated on the timer disk. A stop-clip is now attached onto the rim of the disk and well hand-tightened. The pointed part of the clip indicates the shut-off time, it should be set for 24 hours **and 30 minutes extra** run time. Care must be taken not to confuse am and pm to avoid only 12 hours of run time.
- The fields Month, Day, Year and the present time (in military 24 hour time) are filled out on the data sheet as well as the hour meter reading. This hour reading is compared to the hours previously entered in the Next Brush Change and Calibration due field. If the sampler has reached (or will be reaching during the sampling) the hours indicated the motors will have to be removed at the end of the sampling event for service/calibration.
- The sampler is now turned on manually as done

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previously. The flow recorder is lightly tapped and the stabilized pen reading on the circular chart is read and written into the field provided on the data sheet. The reading is taken in CFM, the distance between two lines equals 2 CFM. The min/max reading should be in the 45 to 55 CFM range, if it deviates significantly it may indicate a problem such as cartridge cover not removed or tear in filter paper.

- Once everything checks out all the covers and doors are shut securely, the cover is taken along, and the next TSP, generally TSP-3, is visited to repeat the above procedure.
- Upon completion of the set-up the airport technician at 880-2220 is called. He/ she will be able to supply the required weather information in the units necessary. Temperature must be accurate to one decimal point. The airport technician takes hourly readings on the hour, the time nearest to the actual start-up event must be chosen for the weather data. This could mean that two different weather data set are required. Example: one sampler was started at 1520h (nearest to the 1500h weather obs.), the other one at 1540h (nearest to the 1600h weather obs.)

3.

Ending the Sampling

- After 24 hours have passed the samplers will be shut down, manually or automatically, and the used filter cartridges returned to the office. A reasonable effort should be made to arrive at the site precisely at the same time they were set the previous day. If the samplers are found still running upon arrival, the Start Sampling Hr. Meter entry is compared to the actual hour meter reading. If at least 24 hours have passed according to these numbers (not watch time) the sampler motor is shut down manually. If not enough time has passed a little wait may be necessary, if the sampler stopped already on its own this step can be omitted.
- Any clips on the edge of the yellow timer disk, stop or others, must be removed and placed at the bottom of the timer housing. Date, time of shutdown in 24 hour time and hour meter reading are entered on the data sheet. The meter hours are compared to the Brush Change and Calibration due at entry. If the meter is in need of service the motors must be removed, serviced and calibrated before the next sampling event five days later. For calibration refer to Section 6. Calibration below.

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- The circular chart is removed and the last pen reading (before it dropped down to zero) is written into the field on the data sheet.
- The roof of the sampler is opened and secured, the cartridge cover is snapped back on and the cartridge removed by loosening the four plastic wing nuts. The sampler roof as well as all the cover and doors are closed securely and rechecked before leaving.
- The same procedure applies to the second sampler. During transport the filter cartridges containing the used filters should be handled carefully and kept horizontal to avoid particles from falling off.
- Upon completion of the shut-down the airport technician at 880-2220 is called. He/she will be able to supply the required weather information in the units necessary. Temperature must be accurate to one decimal point. The airport technician takes hourly readings on the hour, the time nearest to the actual shut-down event must be chosen for the weather data. This could mean that two different weather data sets may be required. Example: one sampler was stopped at 1520h (nearest to the 1500h weather obs.), the other one at 1540h (nearest to the 1600h weather obs.)

4. Lab Procedures

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- Upon returning to the Environment Laboratory the paper filters are removed from the cartridge by taking first the cover and then the frame off. The filters are then folded into quarters using tweezers, lying on the open cartridge base. The contaminated side is always folded in to avoid loss of particles.
- The filter are then placed in a single layer in a preheated pan. The pan must be labeled to identify the filters and the date of the sampling. The filters are placed inside the drying oven and dried at 105° C for 24 hours.
- After 24 hours the pan is removed from the oven and placed in the dessicator until it reaches room temperature, about two hours. The filters should not be left in the dessicator longer than necessary. The dessicator door must be closed during cooling and dry (blue or purple) dessicant must be present in the same compartment.
- The cooled filters are removed and weighed individually

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using a Mettler Toledo AG204 analytical balance. A pedestal has to be put on the scale plate to accommodate the filters, a small beaker works well. The scale must be reset to zero prior to filter placement. The weight in grams up to four decimal points is written on the data sheet.

- The used filters are returned to their original envelopes and stored in the used filter container in the air quality cabinet. The empty filter cartridges and the clipboard are stored at the same location.
- At this time the supply of prepared filters should be checked and restocked if required.

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5.

**Calculation
and Data
Entry**

- The necessary calculations are now performed on the data sheets in the following steps.
- The atmospheric pressure is converted from mb to kPa by using the measurement conversion program and entered on the data sheet.
- Run time hours are calculated and entered (two decimal places) by subtracting the meter hours at start-up from the meter hours at shut-down. If the above procedures were followed carefully this number should never be less than 24.00, or slightly above.
- Average Pressure is calculated and entered by adding the converted pressures at start-up and shut-down and dividing the sum by two.
- Average Temperature is calculated and entered in the same manner.
- Average circular chart is calculated and entered by taking a chart pen reading every three hours (i.e. at 0900h, 1200h, 1500h, 1800h and so on) for a total of eight readings. The sum of these readings is divided by eight to obtain an average.
- These calculations are performed twice, one for each data sheet for each location
- The circular charts are stapled to the data sheet. Each data entry field of the data sheet should now be filled out. Open spaces indicate a neglect that should be rectified at this time.
- Further manual calculation is cumbersome, complicated and prone to mistakes. Instead the data are entered from the data sheets into the HiVol Excel spreadsheet located at "S:\Environment\Data\Air Quality\Hi-Vol\Import\HiVol Data.xls". The TSP value will be calculated automatically once all the data are transferred.

6.

**Calibration
and Brush
Change**

- Calibration of the sampler unit is a complex operation that should only be attempted by trained technicians, never casual students.
- Calibration is required under the following conditions: after three months or 400 sampling hours, after motor maintenance and upon initial installation. Brush changes are required every 400 running hours. If it is recognized

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during sampling that any of these conditions apply a technician should be notified immediately to perform the task.

- Changing the brushes of the electric motors require the removal of the sampler motors and returning them to the environment lab. A partial disassembly needs to be performed to exchange these parts. The exact procedure is covered in the Maintenance and Calibration SWP and can be found in the Operations Manual for Graseby Tisch Environmental TE-5170 Series.
- Calibration of the unit is performed using the Graseby G2835 (Vari-Flo) calibration kit, located in the air quality cabinet. The exact procedure is covered in the Maintenance and Calibration SWP and can be found on Pg. 10-22 in the Operations Manual for Tisch Environmental Model TE-5170 Series. However, the result are not calculated manually but the readings are first entered into the calibration worksheet. Upon return to the office the numbers are transferred into the Excel spreadsheet found at S:\Environment\Data\Air Quality\Hi-Vol\Calibration\Air monit calib worksheet – Calculation Sheet. The spreadsheet formulas will automatically calculate the rather complex computations and determine the correlation coefficient r which must be 0.990 or larger for the calibration to be acceptable. The displayed values slope m and intercept b are entered into the appropriate columns in the HiVol Excel spreadsheet located at "S:\Environment\Data\Air Quality\Hi-Vol\Import\HiVol Data.xls". If r is smaller than 0.990 the calibration must be performed again after a thorough check of the sampler and its components. There are no further adjustments possible to affect the calibration performance. This procedure must be performed twice, once for each TSP sampler serviced. It is advisable that brush changes and calibration are done for both samplers at the same time.

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Documents and Records

[Operations Manual For Tisch Environmental Model TE-5170 Series Total Suspended Particulate MFC High Volume Air Sampler](#)

High Volume Air Sampling Binder, in Environment Library

Air Quality Monitoring Plan in OEMP

[Field Data Sheet](#)

[Field Data Sheet, Example and Instructions](#)

[HiVol Sampler Calibration Worksheet](#)

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Appendix 3

Lichen Monitoring of Dust at the EKATI Diamond Mine, NWT

LICHEN MONITORING AT THE EKATI DIAMOND MINE, NWT



For: Rescan Environmental Services

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December 9th, 2009

SUMMARY

Lichens are useful indicators of the distribution of dust and particulate from a variety of sources, including dry deposition of road dust and dust deposited on snow from mine sites, vehicle exhaust, etc. and long range transport. The chemical analysis of lichen tissue provides a precise measurement of ambient air pollution changes over time. Lichens were collected from 37 sites in 2008 near the EKATI diamond mine and compared to similar collections made in 2005.

The lichens collections made near EKATI Mine in August of 2008 show that the dispersal of dust from the EKATI Mine site and roads is confined to near the mine site, with some exceptions. The effect of long range transport and arctic haze is evident in the data that were collected. However, the concentration of elements from dust is equivalent to background levels in comparison to the literature in most areas, with the exception of those locations near the mine and near roads. Lichen concentrations were also compared to snow meltwater chemistry; with similar results indicating a combination of minor enhancement from snow meltwater near the minesite, declining with distance from the mine. The areas that have been impacted are confined to a small area to the south and west of the mine site.

The lichen data shows a significant decline in the concentration of dust-borne elements in lichens with increasing distance from the mine since 2005, possibly due to dust control measures since the construction of the mine. The element concentrations in lichens also related well to the dust fall monitoring that took place in 2008.



Lichen used in dust monitoring at EKATI Mine, 2005 and 2008:

Flavocetraria cucullata



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Rescan Environmental Services provided logistical support and guidance for this work, requested by BHP Billiton. Joanne Willers and Marc Wen were particularly helpful. Stephen Ban (Wildlife Biologist, Rescan Environmental Services), and Chris Blechert (Summer Student, B.H.P. Billiton Diamonds Inc.) are gratefully acknowledged for their diligent field work collecting lichens for this project.



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1.0 Introduction

The EKATI diamond mine is located 200 km south of the Arctic Circle in NWT Canada¹. EKATI has a strong environmental stewardship policy that includes dust control, in order to protect arctic resources. Rescan Environmental Services (RES) commissioned a lichen toxicologist to re-assess an existing RES dust monitoring program. Lichens have been used to indicate dust dispersal from single and multiple sources in many industrial and background settings, throughout the world, but especially in the subarctic and Arctic regions (Nash and Gries, 1995; Bargagli et al. 1999; Seaward 1992, Ferry et al. 1973, France and Coquery, 1996). They are extremely accurate and precise in showing tissue concentrations that relate directly to ambient dust concentrations (Nieboer et al. 1978; Bennett and Wetmore, 1999; Loppi et al., 1999). Further, when ambient dust concentrations decline over time, a subsequent decline in tissue concentrations occurs (Seaward, 1992; Seaward and Letrouit-Galinou, 1991). Dust particles are trapped in the lichens tissues and surfaces and are lost as the lichen grows. The opposite is true, also. If dust concentrations increase, a subsequent increase in tissue concentrations occurs. These fluctuations in concentrations can be related to dust fall monitoring (Mulgrew and Williams. 2000; Rossbach et al, 1999).

Different lichen genera and species accumulate different concentrations of dust according to their physical structure and biochemistry (Rhoades, 1999), therefore it is necessary to use the same or at least similar species in each plot. Comparisons can be made to other dust dispersion studies using lichens, if they use similar species (for example use of *Peltigeras* are very common) as for the most part, lichens have a trans-boreal distribution with the same species occurring in most dry or open Temperate, Boreal, Taiga and Sub-Arctic habitats. Also lichens are an important forage plant for Barren Ground Caribou, and their contributions of various dust substances to Caribou diets and bioaccumulation of substances in Caribou has been studied in the various places where caribou are an important part of human diets (Aastrup et al. 2000).

The lichen *Flavocetraria cucullata* was used by Rescan Environmental Services (2006) in 2005 to show the distribution of dust from the EKATI Mine. A similar methodology was used in the 2008 sampling, to indicate the characteristics of dust dispersion from the EKATI mine site and from secondary sources. In 2008, both *Flavocetraria cucullata* and a complex that included *Peltigeras*, mainly *rufescens* were collected for comparison to the 2005 sample and to show trends in ambient dust deposition near the EKATI Mine site.

2.0 Methods

A total of 37 Air Quality plots (AQ-#) were sampled for lichens to indicate dust dispersion from EKATI Mine, between August 9th and 12th of 2009. Most were accessed by helicopter, two were accessed by road. Most sample areas were within 100 meters of the 2005 sample locations and likely overlapped the 2005 locations in space (Rescan Environmental Services, 2006). Five additional sites were included to cover gaps in the

¹ <http://www.bhpbilliton.com/bb/ourBusinesses/diamondsSpecialtyProducts/ekatiDiamondMine.jsp>



sample area to the north and south of the mine site. The AQ plots have a tendency to be more concentrated close to the Mine Site, and more spread out in the 'background' areas. The total sample covers a large area of approximately 70 km (west to east) by 40 km (south to north) with the mine sites located near the centre of this oblong area, and to the southeast. Figure 1 shows the location of the AQ plots. Distances from the plots to the mine site were measured from the centre of the lichen collection plot to the mine Administration Building using GIS.

2.1 Sampling

In each AQ Biomonitoring plot, lichens (*Peltigera rufescens* and *Flavocetraria cucullata*) were sampled into two bags for each species for each of the three personnel collecting in the field (K. Enns, S. Ban and C. Blechert) using the methods described in Bargagli and Nimis (2002), for a total of six bags to an AQ location. In some instances, where samples were abundant, replicates (subsamples) were taken from one or more of the three bags, to indicate variance in concentrations within an AQ location (Hathaway, 2005). Neither samples, nor species were mixed between AQ site locations. Thalli were separated from their substrate by hand, using latex gloves, and placed in labeled paper bags. Gloves were changed between AQ plots. The upright foliose lichen *Flavocetraria cucullata* was collected in each of the 37 AQ plot, and *Peltigera rufescens* was collected in 27 AQ plots, as it was not as common as *F. cucullata* if it could be found. Replicates were split from the samples, to show the variance in absorption of dust. Average concentrations for each of the two species represent the composited sample for each Air Quality Monitoring Plot.

The lichens were refrigerated between collection and the drying and sorting lab, where they were cleaned of plant debris and holdfast tissues. They were not washed (see Bargagli and Mikhailova, 2002). The samples were laid out to dry at 16 degrees C for 2 weeks and were frequently turned until they no longer changed weight (i.e. dry). The samples were then ground in a stainless steel coffee mill used only for lichen sample processing, and the mill was cleaned with dry tissue, followed by alcohol, then wiped dry with clean dry tissue a second time. Some of the subsamples have been archived for cross referencing or QA QC, if required. Spiked samples of the same species are available for comparison, as well.

The dried and ground samples were shipped in a single cooler with a cold pack to ALS Laboratory in December of 2008. Elemental contents of tissues were determined using ICP-MS (Inductively Coupled Plasma Analysis Mass Spectrophotometry) with the lowest detection limits possible for MS. The preparation method for ICP – MS analysis was a nitric acid with hydrogen peroxide preliminary digest (similar to Rusu, 2002). However, microwave digestion was replaced by hotblock digestion (tubes with watchglasses; C. Dang pers com. 2009) similar to the open vessel procedure described in Rusu (2002). Mercury was determined using a cold vapor technique with an automatic mercury analyzer and Atomic Absorption Spectrophotometry. The results arrived in late January of 2009. Analysis consisted of ICP-MS (Inductively Coupled Plasma Analysis Mass Spectrophotometry) with at least 0.05 ppm detection limits.



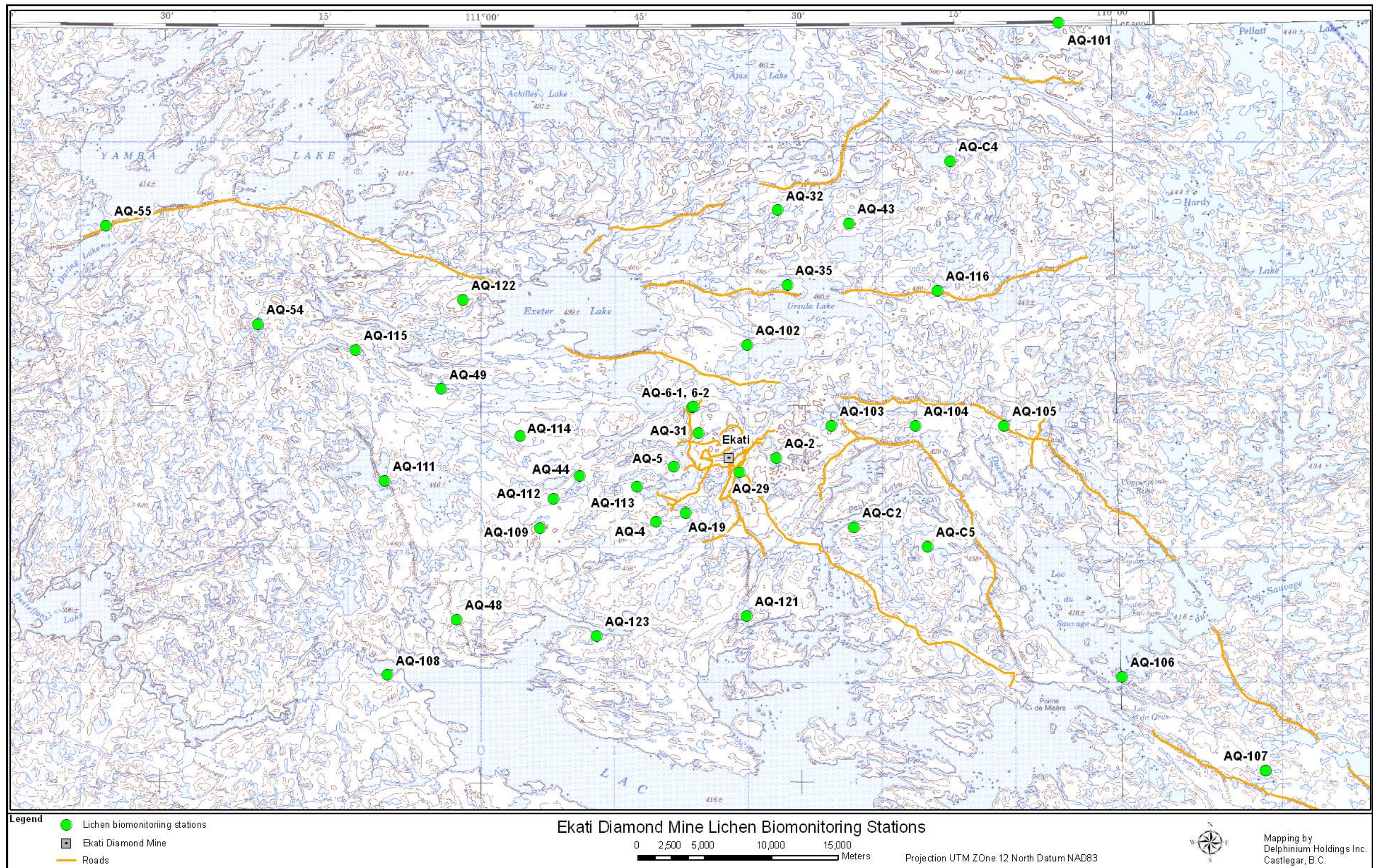


Figure 1. Location of the biomonitoring stations around the EKATI Diamond Mine in 2008, with the 14 sample plots for which lichen tissue concentrations were compared to 2005.

3.0 Statistical analyses

Trends in the lichen data were compared to the previous sample (Rescan Environmental Services 2006), and to values in the literature. Variations in elemental concentrations at sites with multiple samples were compared to sites where only one sample was collected (due to paucity of lichens for sampling). Note: multiple samples were collected where possible, some areas are very lichen-poor as Caribou use of this forage plant is heavy throughout the study area. *Peltigera rufescens* absorption is well referenced in the literature, therefore comparisons were made to the literature using mainly this species, but *Flavocetraria cucullata* was also compared where applicable.

The gradation of concentration vs distance from the mine site of the elements Chromium, Magnesium, Vanadium and Nickel was plotted as a preliminary indication of dust behavior, as these elements appeared to show the strongest relationship with distance in Rescan Environmental Services (2006). Concentrations were also plotted as low, medium and high concentrations to show spatial relationships with the mine site and with roads.

Statistical analyses were conducted to answer two questions:

- 1) Is there a difference in element concentrations in co-located *Flavocetraria cucullata* between 2005 and 2008; and
- 2) Is there a relationship between dust fall measurements (maximums) and the concentration of elements in *Flavocetraria cucullata*.
- 3) Is there a relationship between snowmelt water measurements (maximums) and the concentration of elements in *Flavocetraria cucullata*.

These questions are addressed in separate sections below.

3.1 Comparisons between 2005 and 2008

The graphs of elemental concentrations in *Flavocetraria cucullata* in 2005 vs. 2008 (Appendix 1) for matched sites were examined for trends. Elemental concentrations were then analyzed using unbalanced two-way analyses of variance (ANOVAs), tested with permutations (n=9999). Unbalanced ANOVAs were necessary as data for a different number of replicates of *Flavocetraria cucullata* per AQ location and between years were collected. Two-way ANOVAs allowed us to examine the data for differences in average concentration of elements, and to determine if differences were statistically significant between plots and between years, as well as determining if interactions occurred between sites and years. Interactions between sites and years would mean that some specific sites showed differences in average element concentrations between years, but not others. This trend could indicate that some sites are showing an increase in elemental concentrations, and therefore are more susceptible to receiving dust from EKATI mining operations and road use than other sites.



Principal component analysis (PCA), was used to summarize and illustrate the relationships between plots and element concentrations over time. PCA is a multivariate statistical method that represents the scatter of objects (AQ locations) in a space of reduced dimensionality compared to the original multidimensional dataset (Legendre and Legendre 1998). The axes used in the diagram are the two axes that express the largest fraction of variability in element concentrations in the lichen tissue from the AQ locations. With scaling of type 1, the projection of the AQ locations at a right angle on the vector of each element concentration approximates their value along that vector. PCA approximates the Euclidian distances among objects; thus the closest the AQ locations are to one another, the more similar they are in terms of their element concentrations. This analysis shows trends in similarity of dust deposition between 2005 and 2008, as reflected in the lichen concentrations over the largest area surrounding EKATI Mine. The unbalanced two-ways ANOVAs and PCA were performed using R language (version 2.8.0; R Development Core Team, 2007).

3.2 Comparison between elements in lichens, dust fall and snow melt water.

Element concentrations in dust fall monitors for 2008 were analyzed at several sites around the mine in June, July and August 2008. Snow samples were collected between April 9 and April 21, 2008. The methods for snow and dust collection are described in Rescan (2009).

Dustfall comparison

The data collected at co-located dustfall sites were compared to element concentrations in lichens collected in 2008. Only those dust fall site locations that were within 2 km of lichen monitoring AQ locations were used in the analysis, and of those, only two sites (AQ 49 and AQ 54) were directly co-located. Distances from dust fall to AQ sites were estimated in GIS. The question asked of the data was as follows:

Is there a relationship between metal concentrations in dustfall measurements and the concentration of elements in *Flavocetraria cucullata*.

As a first step, a series of graphs were produced to study the relationships between lichen element concentrations and dust fall concentrations. Only those elements in common (dust fall analysis and ICP total element concentrations) were compared.

Elements concentrations in dust fall were then screened to keep only the elements showing variation between sites. Then a canonical analysis was used to assess the relationship between element concentrations in lichens and element concentrations from the dust fall data. The form of canonical analysis used was an extension of multiple regressions combined with an ordination technique. It involves a matrix Y, containing the element concentrations in lichens, constrained by a matrix X, containing the dust fall element concentrations. Direct comparison analysis allows one to directly test *a priori* ecological hypotheses by extracting all the variance of Y that is related to X, and conduct formal tests of these hypotheses (Legendre and Legendre 1998). Orthogonal axes are produced by canonical analyses, which allow scatter diagrams to be plotted. A



redundancy analysis (RDA) was used, as it preserves Euclidian distance in the ordination spaces and allows the computation of adjusted- R^2 (Legendre and Legendre 1998).

The R^2 is the coefficient of determination of the multiple regressions embedded within the canonical analyses; it measures the fraction of variance in Y that is explained by a linear combination of the variables in X (Sokal and Rohlf 1995). The adjusted- R^2 is a modification of the R^2 that accounts for the number of explanatory variables included in the multiple regressions or canonical models. Increasing the number of explanatory variables in a model would automatically increase the R^2 , even if the new variables do not improve the model more than would be expected by chance. In other words, any model containing as many variables as the number of data points can be adjusted to perfectly fit the data, thereby artificially inflating the R^2 (but decreasing the degrees of freedom necessary to test their significance; Legendre and Legendre 1998). Using the adjusted- R^2 ensures that the proportion of variance of Y that is explained by the variables in X is not influenced by how many variables are in X.

A forward selection of the variables was performed prior to the analysis to control for the independent variables to be included in the models, allowing us to preserve those variables that are found to significantly contribute to variance. The forward selection procedure starts with no variables in the model, then adds one by one the variables provoking the largest increase in R^2 , provided that this increase is significantly different from zero. It continues until no more variables produce a significant increase in R^2 in the matrix X (Legendre and Legendre 1998). Apart from avoiding the inclusion of variables that do not significantly contribute to the models, selection of the independent variables also allows models to be simpler, and generally easier to interpret.

Both dependent and independent variables were standardized prior to the analyses as they were not in the same dimension (Legendre and Legendre 1998). The forward selection of the variables and the RDA were performed in the R language (version 2.8.0).

Snow meltwater comparison

In order to examine the relationship between lichen thalline elemental concentrations and snow water elemental concentrations, plot-wise comparisons were made. The question asked of the data was as follows:

Is there a relationship between metal concentrations in snow water measurements (maximums) and the concentration of elements in *Flavocetraria cucullata*.

Element concentrations in snow water samples in 2008 were analyzed at several sites around the mine in June, July and August 2008. The data collected at these sites were compared to element concentrations in lichens collected in 2008.

As a first step, a series of graphs were produced to study the relationships between lichen element concentrations and dust fall concentrations. Only those elements in common (snow water analysis and ICP total element concentrations in lichen tissue) were compared. Some of the graphs were done with and without outliers, in order to better see the distribution of the elemental data in the graphs.



Elements concentrations in snow water samples were screened to keep only the elements showing variation between sites. A canonical analysis was used to assess the relationship between element concentrations in lichens and element concentrations from the snow water samples. The form of canonical analysis used was an extension of multiple regressions combined with an ordination technique. It involves a matrix Y, containing the element concentrations in lichens, constrained by a matrix X, containing the snow water element concentrations. Direct comparison analysis allows one to directly test *a priori* ecological hypotheses by extracting all the variance of Y that is related to X, and conduct formal tests of these hypotheses (Legendre and Legendre 1998). Orthogonal axes are produced by canonical analyses, which allow scatter diagrams to be plotted. A redundancy analysis (RDA) was used. RDA preserves Euclidian distance in the ordination spaces and allows the computation of adjusted- R^2 (Legendre and Legendre 1998).

The R^2 is the coefficient of determination of the multiple regressions embedded within the canonical analyses; it measures the fraction of variance in Y that is explained by a linear combination of the variables in X (Sokal and Rohlf 1995). The adjusted- R^2 is a modification of the R^2 that accounts for the number of explanatory variables included in the multiple regressions or canonical models. Increasing the number of explanatory variables in a model would automatically increase the R^2 , even if the new variables do not improve the model more than would be expected by chance. In other words, any model containing as many variables as the number of data points can be adjusted to fit the data, thereby artificially inflating the R^2 (but decreasing the degrees of freedom necessary to test their significance; Legendre and Legendre 1998). Using the adjusted- R^2 ensures that the proportion of variance of Y that is explained by the variables in X is not influenced by how many variables are in X.

A forward selection of the variables was performed prior to the analysis. Forward selection allows for the control for the independent variables to be included in the models. It preserves those variables that are found to significantly contribute to the model. The forward selection procedure starts with no variables in the model, then adds the variables one by one, with the largest increase in R^2 preserved, provided that the increase is significantly different from zero. It continues until no more variables produce a significant increase in R^2 in the matrix X (Legendre and Legendre 1998). Apart from avoiding the inclusion of variables that do not significantly contribute to the models, forward selection of the independent variables also allows models to be simpler, and generally easier to interpret.

Both dependent and independent variables were standardized prior to the analyses (Legendre and Legendre 1998). Outliers were excluded and data were averaged among replicates within sites to avoid pseudoreplication (Hurlbert 1984). When concentrations of metals were below the delectability threshold, the value of the threshold was used. The forward selection of the variables and the RDA were performed in the R language (version 2.9.2).

Following the analysis of the data, the snow water and lichen concentrations, and trends in the data were compared with literature. Patterns in the snow water – lichen uptake data were also compared with the interpretation of dust fall data vs. lichen concentrations.



4.0 Results

The wind data from the previous decade shows multidirectional winds, with some trends toward winds from the southeast and from the east (data not shown). Isopleths of concentrations of elemental concentrations in lichens were plotted using mapping software, but they did not show a strong directional pattern. However, other trends were evident, and they are discussed below.

4.1 Characteristics of element concentrations in lichens from near EKATI mine.

The lichen results are summarized in Appendix 2. They show that *Peltigera rufescens* (a group of *Peltigera* spp. most likely to be variations of species *P. rufescens*) is more absorptive of elements than *Flavocetraria cucullata*, which is typical (Rhoades 1999) and due to its more complex and absorptive surface. Concentrations of elements in lichen tissue from the AQ locations around EKATI Mine are similar to published 'background' levels from the literature (Table 1).

Table 1. Comparison between four crustal element concentrations in similar lichens from the literature vs those found at EKATI Mine.

Element	Background concentrations from the literature ¹	EKATI Mine Site Concentrations
Copper	6 - 20 ppm in <i>Parmelia sulcata</i> <1 – 50 ppm in Canadian Arctic Background Areas	4.8 ppm to 18.50 ppm in <i>Peltigera rufescens</i> 0.88 ppm to 11.20 ppm in <i>Flavocetraria cucullata</i>
Chromium	0.5 – 10 ppm in <i>Parmelia sulcata</i> 0 – 10 ppm in Canadian Arctic Background Areas	0.6 ppm to 22 ppm in <i>Peltigera rufescens</i> 0.5 ppm to 12 ppm in <i>Flavocetraria cucullata</i>
Zinc	50 – 80 ppm in <i>Parmelia sulcata</i> 20 – 500 ppm in Canadian Arctic Background Areas	32 ppm to 70 ppm in <i>Peltigera rufescens</i> 11 ppm to 56 ppm in <i>Flavocetraria cucullata</i>
Manganese	5 – 120 ppm in <i>Parmelia sulcata</i> 10 – 130 in Canadian Arctic Background Areas	68.9 ppm to 357 ppm in <i>Peltigera rufescens</i> 25.3 ppm to 228 ppm in <i>Flavocetraria cucullata</i>

1. Bargagli and Mikhailova (2002), Nieboer et al. (1978), Rhoades (1999), Nash and Gries (1995).



Table 1 shows that maximum concentrations are higher than average backgrounds for manganese but not for copper, zinc, or chromium. Further Rhoades reports background elemental concentrations from various world literature on lichen uptake of dust born elements indicates that only maximum adsorption near the mine site was greater than average background levels in so-called pristine or un-impacted areas of the world. For example vanadium backgrounds are reported as 0 – 10 ppm whereas vanadium in the more adsorptive lichen *Peltigera rufescens* ranged from 0.5 to 9.42 near EKATI Mine. Strontium background concentrations range from 0 to 700 ppm, whereas strontium in the *P. rufescens* ranged from 5.04 to 49 ppm near EKATI Mine. Molybdenum ranges from 0 – 3 ppm as a background value in the literature, whereas molybdenum at EKATI Mine in *P. rufescens* ranged from 0.5 to 0.98 ppm. These comparisons indicate that while enhancement from dust is occurring near the mine site, the concentrations are still comparable to non-impacted background levels in the world, generally, with some exceptions for AQ locations very near active roads or mining operations.

Nitrogen concentrations range from 6,000 to 50,000 ppm as a world background, whereas at EKATI Mine, the nitrogen-fixing lichen *Peltigera* spp. (*rufescens* group) had nitrogen concentrations ranging from 2,100 ppm to 3,970 ppm, and the non-nitrogen fixing *Flavocetraria cucullata* had nitrogen concentrations ranging from 320 ppm to 640 ppm. Figure 2 shows the distribution of N in *Flavocetraria cucullata*.



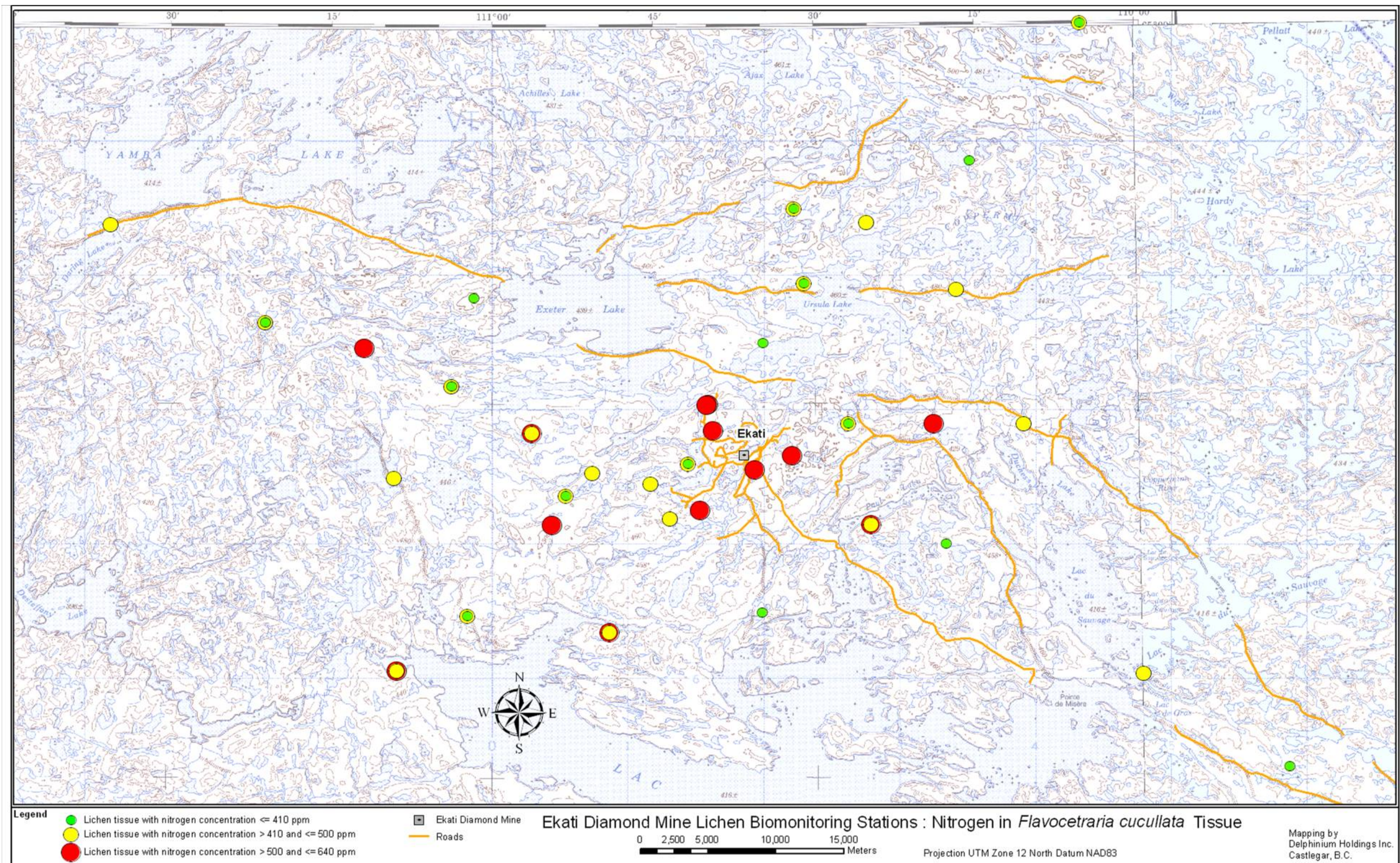


Figure 2. Bubble plot of N in *Flavocetraria cucullata* near EKATI mine. .

Figure 2 shows that nitrogen concentrations can be high near the mine, but also can be sporadically high at distances from the mine. Some of the enhancement may be due to fertilizer effect by barren ground caribou. The lichens taken in the collections had been heavily grazed and use by barren ground caribou of lichens is substantial in the area of interest. Figure 3 shows travel corridor use by caribou in the study area. Almost all the AQ locations had established caribou use patterns.



Figure 3. Travel corridors of barren ground caribou near the EKATI mine (photograph taken from the helicopter).

One of the reasons for the large range in nitrogen concentrations in lichens from background locations in the world, and in the study area, is due to various lichen species differing ability to absorb nitrogen, but also due to the variety of atmospheric and pollution-related sources of N. Ammonium sulphates and NO_x from vehicle and stationary exhaust has been very successfully monitored using lichens (van Herk, 2002; Bruteig, 1992), and can be a significant component of exhausts, especially diesel but other fuels as well, depending on vehicle type and other factors (Seigneur 2009). Further these substances do tend to accumulate in the arctic and they can not be attributed to local sources alone due to long range transport of nitrogenous compounds to the arctic, particularly in summer (Ishizaka et al. 1989).

Despite the variation in concentrations, though, there is a relatively low overall range of concentrations of N at EKATI Mine. This indicates that vehicle exhaust and various



source emissions of NO_x are contained near the mine site at present, but that overall enhancement is influencing N concentrations, and will likely to continue to influence lichen uptake of N. Any dramatic changes in N concentrations in *P. rufescens* group over time will be useful to indicate if depositional N-related acidification or nitrification of the arctic environment is occurring (Nash and Gries, 1995).

Similar to nitrogen, total sulphur concentrations in lichens are also a reliable indicator of transport and fate of ammonium sulphates, sulphate particulate deposition, and sulphur dioxide dispersal from anthropogenic sources (Case and Krouse, 1980; Takala et al., 1991). Figure 4 shows the distribution of concentration classes of sulphur in the tissue of *Flavocetraria cucullata*. Background concentrations of sulphur in lichens range from 50 to 2000 ppm (Nieboer et al. 1978). At EKATI Mine the concentrations in *P. rufescens* ranged from 253 ppm to 1,760 ppm and in *Flavocetraria cucullata*, S concentrations ranged from 258 to 681 ppm. One of the highest outliers is at AQ 55, a Government of Northwest Territories (GNWT) scientific research base camp at Yamba Lake (Figure 5) . They had a diesel generator, which has caused a small spike in S concentrations at this location (see right).

The concentrations of S² show the effects of stationary and mobile sources at the mine, but also very minor secondary sources at distance from the mine. In general, however, levels are still considered below background and are not similar to industrial or even rural areas of Canada. Industrial and rural concentrations of sulphur range as high as 4800 ppm (Nash and Gries, 1995).

²Sulphur concentrations in 2008 were higher than in 2005 due to the use of ICP-MS in 2008 vs LECO sulphur in 2005. ICP-MS extracts a proportionately higher concentration of S from tissue. The patterns in variation in S were similar within the years and between years, but ICP-MS should be used for all sampling in future.



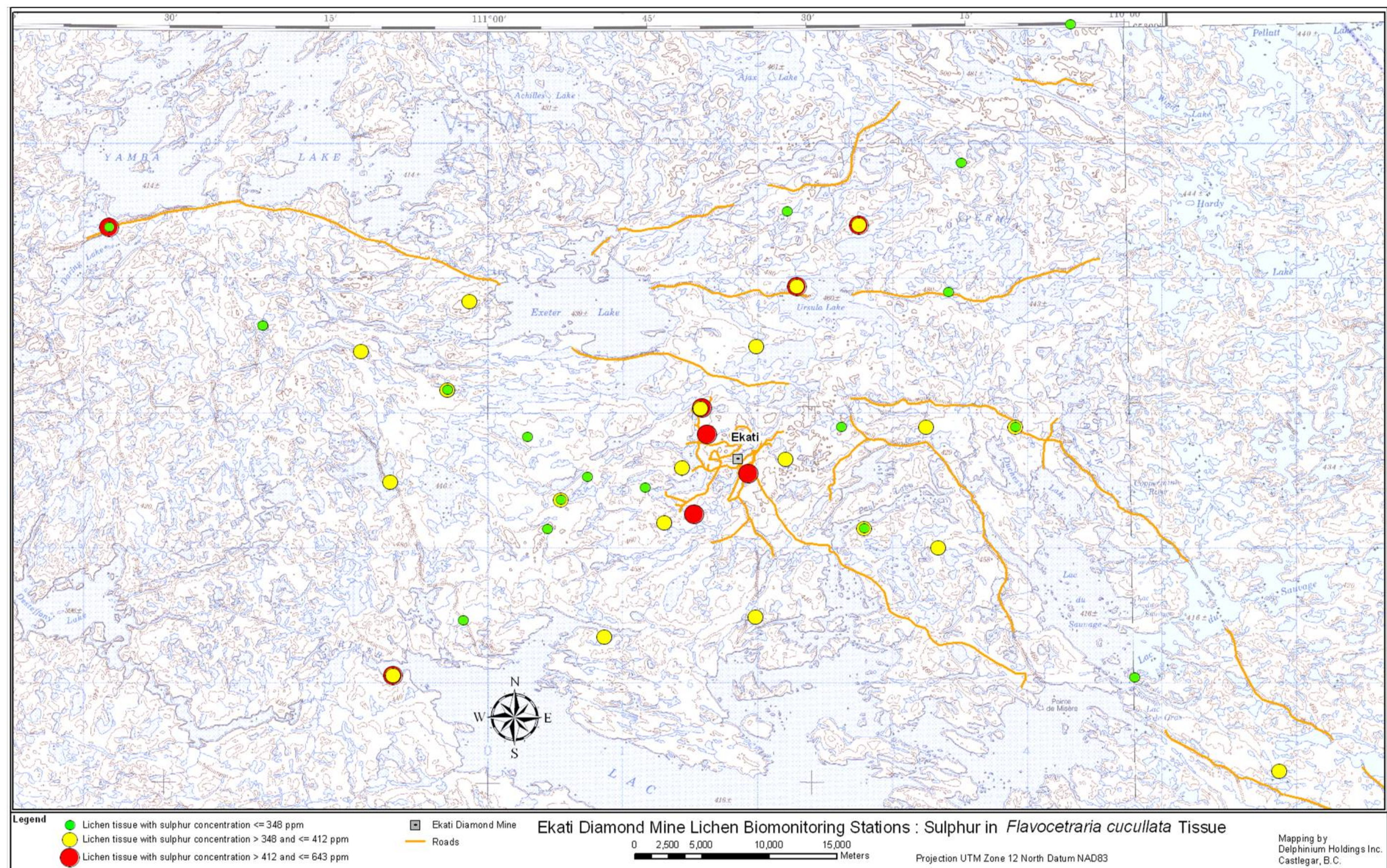


Figure 4. Bubble plot of S (by ICP –MS) in *Flavocetraria cucullata* near EKATI mine. . .



Figure 5. Secondary source of S and N: GNWT Research Camp at Yamba Lake, August 10th, 2009

Although S and N show considerable variation in concentration over the landscape, crustal elements attributable to dust appear to be contained to areas near the EKATI mine. There is a tendency for higher concentrations of elements in lichens to occur to the south and south west of the main mine site buildings, and to be clustered around of the mine site itself. Figures 6 – 8 show the concentration gradient of three typical crustal elements with high variation of concentrations in average road or exposed earth dust; nickel, magnesium and aluminum. Figure 6 shows a single outlier point occurs at AQ116. This site was revealed in the post sampling assessment to have an ice road near it, and it is therefore an outlier in the data set and sampling for this site should be moved to the east. Also, as can be seen in Appendix 1, sulphur concentrations were reported as higher in 2008 than in 2005. This is because sulphate sulphur was determined using LECO analysis in 2005 and total S was determined in 2008, using ICP-MS. It is clear from the figure presented in Appendix 1 that the concentration of S and sulphate declined over distance from the mine site in a similar fashion, however. Archived samples of lichen from 2008 can be used to develop a correction factor for the 2005 data, if necessary. The characteristics of sulphur concentrations in relation to distance from the mine site are of interest, however, and this is discussed below.



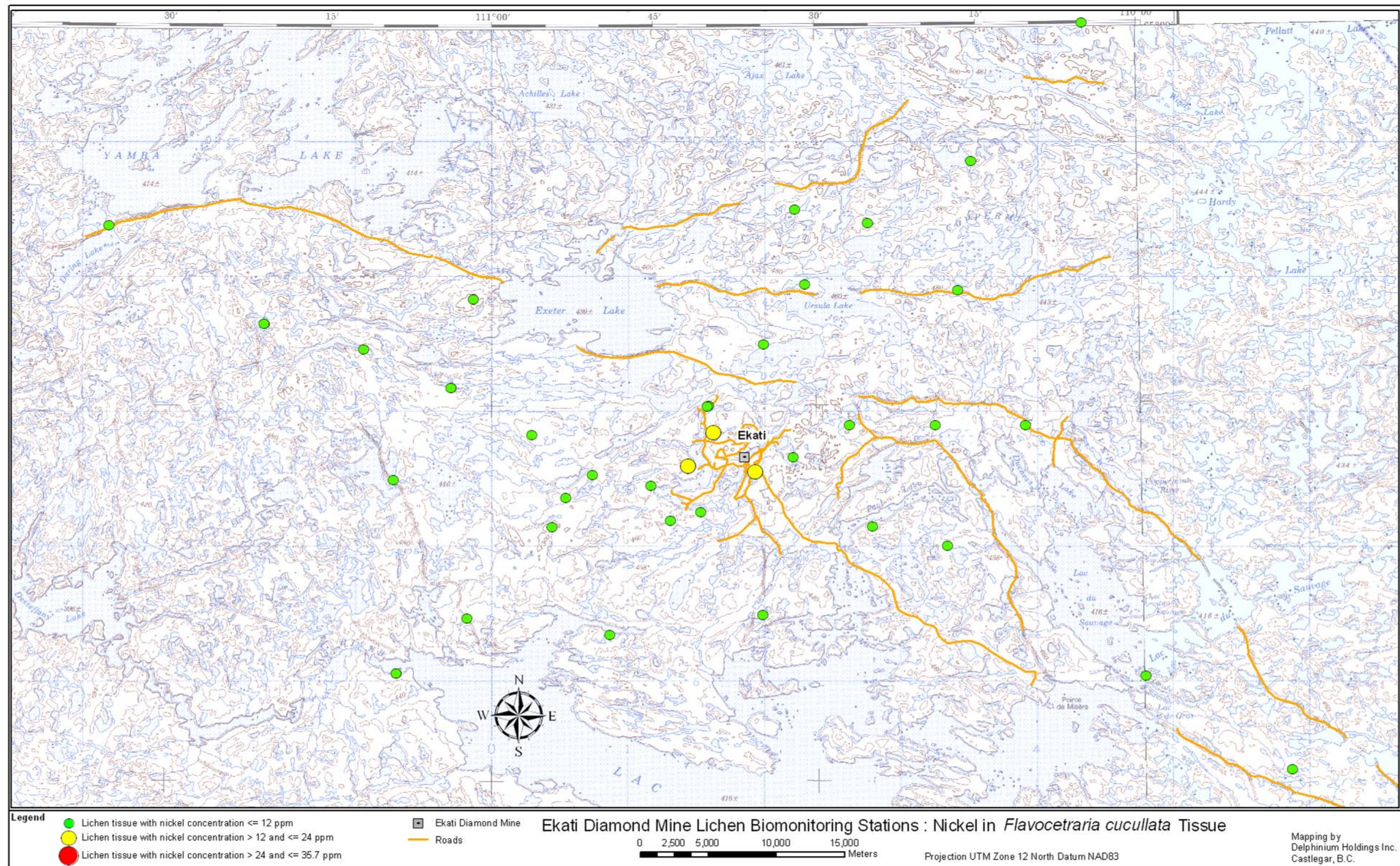


Figure 6. Map of the concentrations of nickel in *Flavocetraria cucullata* tissues around the mine in 2008.

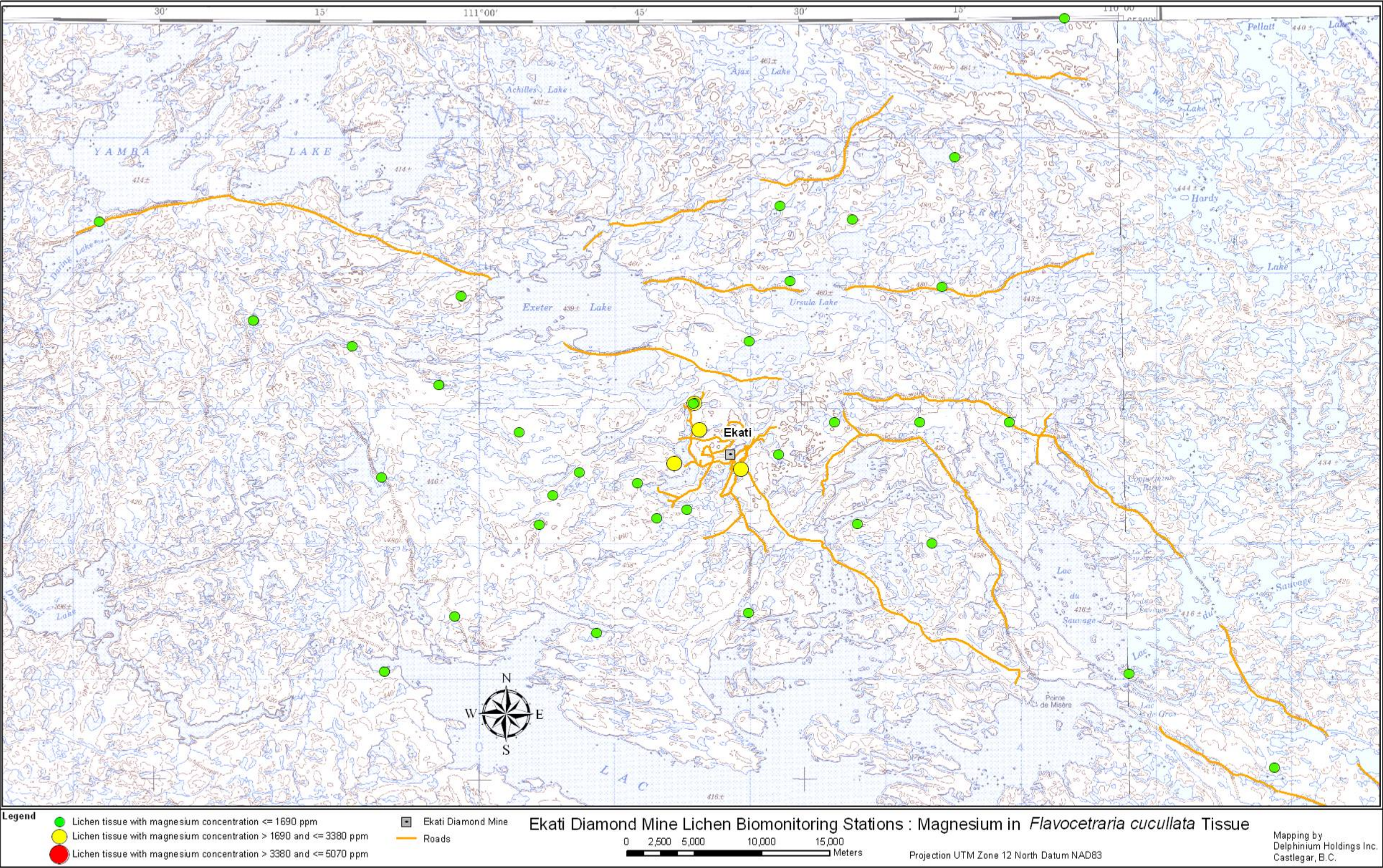


Figure 7. Map of the concentrations of magnesium in *Flavocetraria cucullata* tissues around the mine in 2008

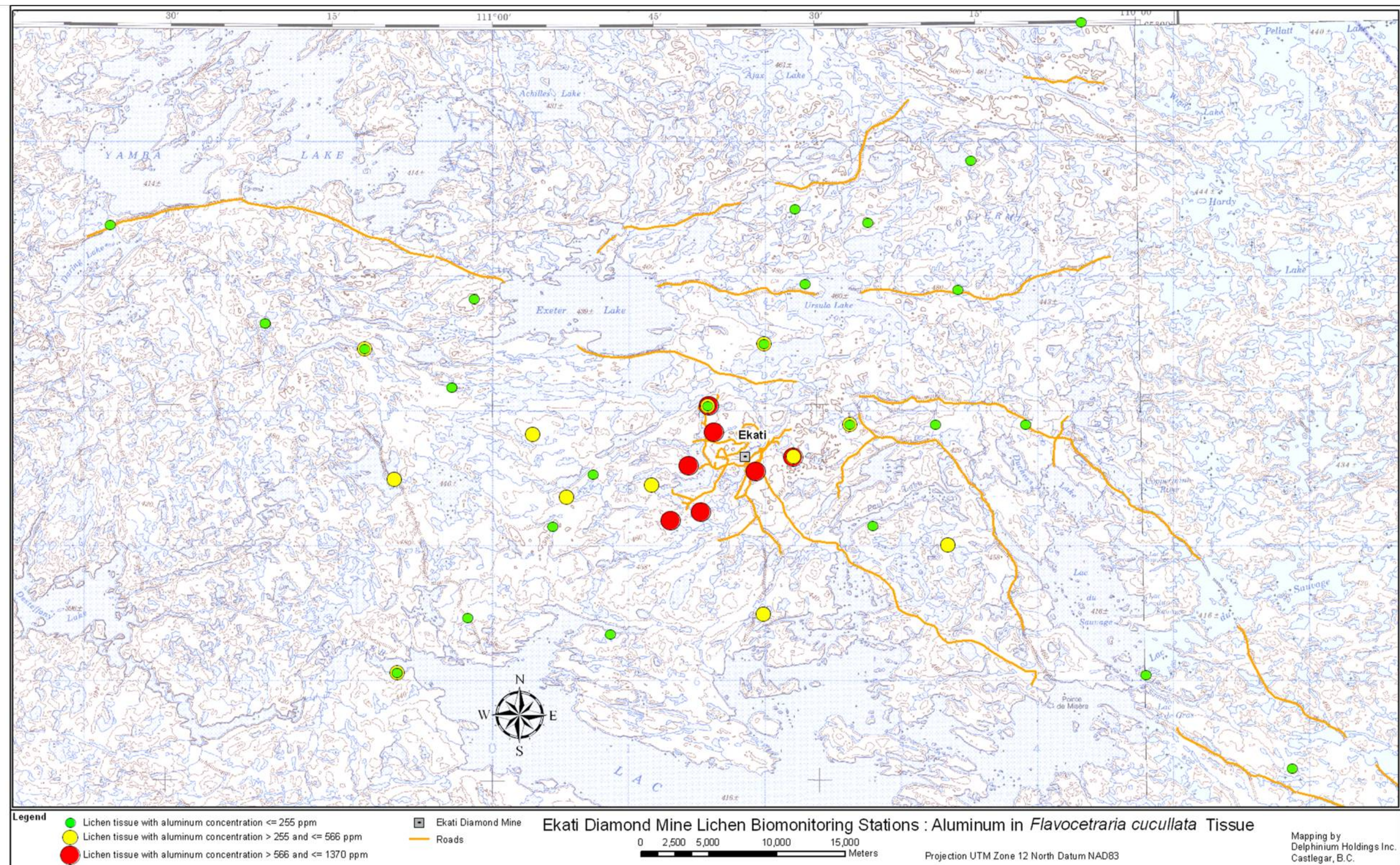


Figure 8. Map of the concentrations of aluminum in *Flavocetraria cucullata* tissues around the mine in 2008...

Therefore, in contrast to most of the non-volatile metals and crustal elements, which tend to decline with distance from the mine site, sulphur and nitrogen concentrations substances seem to have a more generalized distribution. Most of the sources of S and N in the lichen tissues are from depositional materials that can re-volatilize and accumulate in the Arctic. Concentrations of S and N in lichen tissue reflect local sources but also arctic haze and subsequent bioaccumulation.

4.2 Comparisons between 2005 and 2008

Fourteen sites were sampled in both 2005 and 2008 and were used for the comparisons of element concentrations in *Flavocetraria* tissues between years. They are AQ-2, AQ-4, AQ-5, AQ-6, AQ-32, AQ-35, AQ-43, AQ-48, AQ-49, AQ-54, AQ-55, AQ-C2, AQ-C4 and AQ-C5. They are located at various distances around the EKATI mine. A total of 24 elements were measured in *Flavocetraria cucullata* tissues in both 2005 and 2008. Table 2 lists the elements along with their symbols. All elements were measured in mg/kg.

Table 2. Elements analyzed in *Flavocetraria cucullata* in 2005 and 2008. Sulphur was analyzed by LECO and ICP-MS.

Elements	Symbols
Aluminum	Al
Antimony	Sb
Arsenic	As
Barium	Ba
Beryllium	Be
Bismuth	Bi
Cadmium	Cd
Calcium	Ca
Chromium	Cr
Cobalt	Co
Copper	Cu
Lead	Pb
Lithium	Li
Magnesium	Mg
Manganese	Mn
Mercury	Hg
Molybdenum	Mo
Nickel	Ni
Selenium	Se
Thallium	Tl
Tin	Sn
Uranium	U
Vanadium	V
Zinc	Zn



Graphs were developed for each element showing the variation of concentrations in 2005 and 2008 according to the distance from the mine. Not all elements varied in the same way in lichen tissue over time. Six elements clearly showed higher concentrations in lichen tissues in 2005 compared to 2008. They were Al, As, Li, Mo, U and V. Figure 9 shows an example of such relations for As.

Graphs made for Ba, Cu and Hg suggested the opposite relationships: on average, their concentrations in lichen tissues seemed slightly higher in 2008 than in 2005 (see Figure 10 for an example with Hg). However, the concentrations, especially of Hg are very low. Also, Hg is an element with the potential to re-volatilize, and is highly mobile (as is Arsenic: see Appendix 1). While the concentrations are very low, they are declining only slightly with distance. The crustal elements Ba and Cu may be from dust origin, but again the difference in actual concentrations is not great.

Some elements did not show any clear tendencies in terms of differences between years or distance from the mine; that was the case for example for Mn, Ni, Tl, Zn (Figure 11), Cd, Ca and Cr.

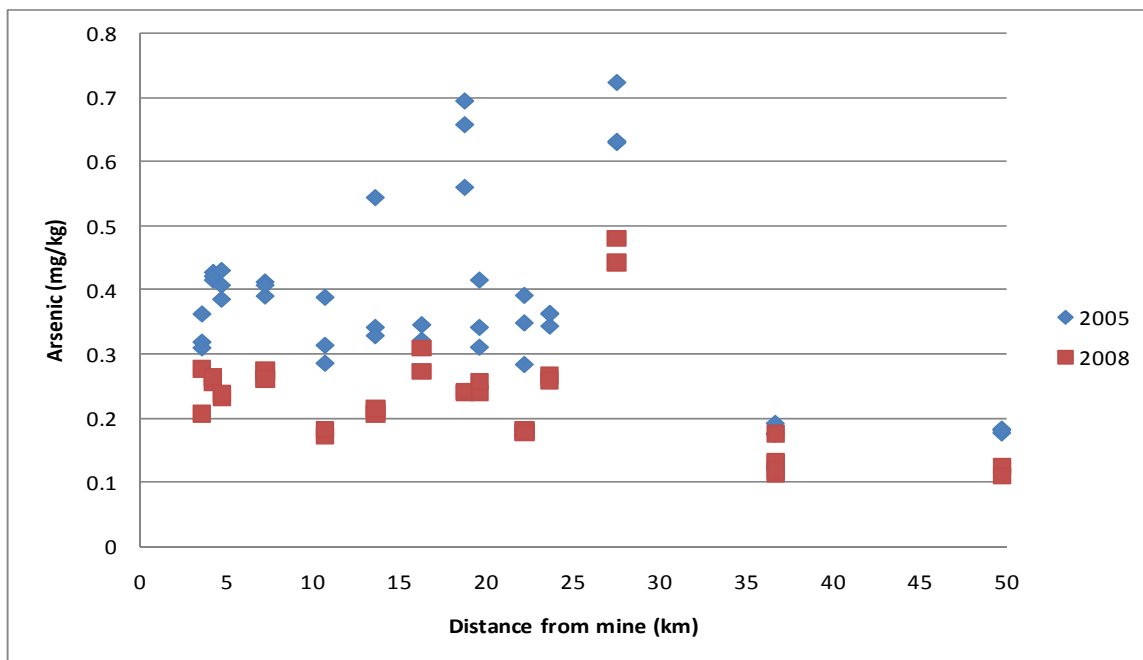


Figure 9. Concentrations of Arsenic (As, mg/kg) in lichen tissues in 2005 and 2008 according to the distance from the mine



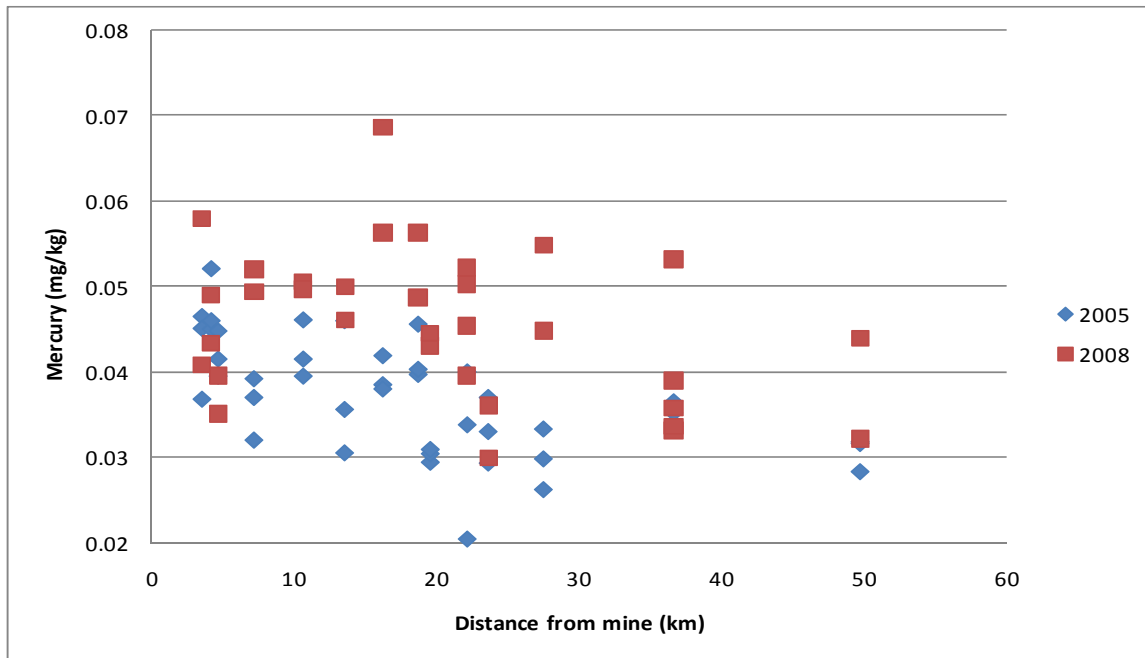


Figure 10. Concentrations of Mercury (Hg, mg/kg) in lichen tissues in 2005 and 2008 according to the distance from the mine

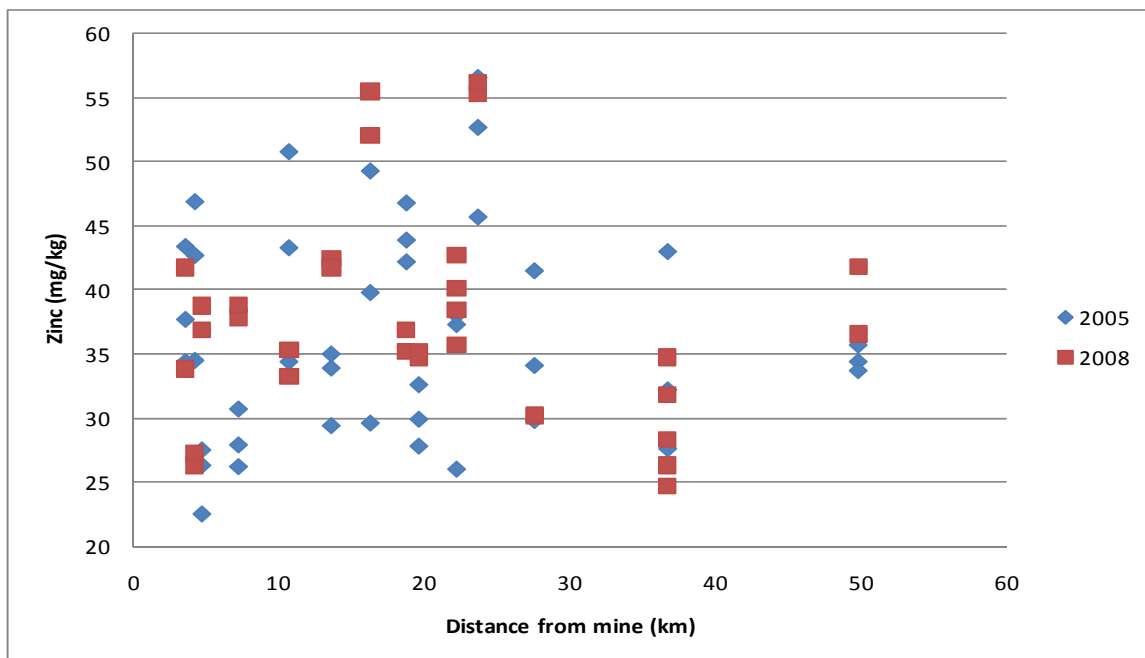


Figure 11. Concentrations of Zinc (Zn, mg/kg) in lichen tissues in 2005 and 2008 according to the distance from the mine



No variations at all in lichen tissues concentrations for any of the two years were observed for Sb, Be, Bi, Se and Sn. Overall, the change in concentrations of elements in *Flavocetraria cucullata* has been mainly a decline in elemental content. This may be due to the advent of dust suppression at the airport in 2006 and the continuation of dust suppression programs from 2006 to the present.

Also in both years, but especially in 2005, the element concentrations are roughly inversely proportional to the distance from the mine. In particular, Al, Cd, Ca, Co, Pb, Li, Mg, Mo, Ni, U and V concentrations declined with distance. Figure 12 shows an example for nickel. This is also a good indication that dust suppression has been effective since 2006.

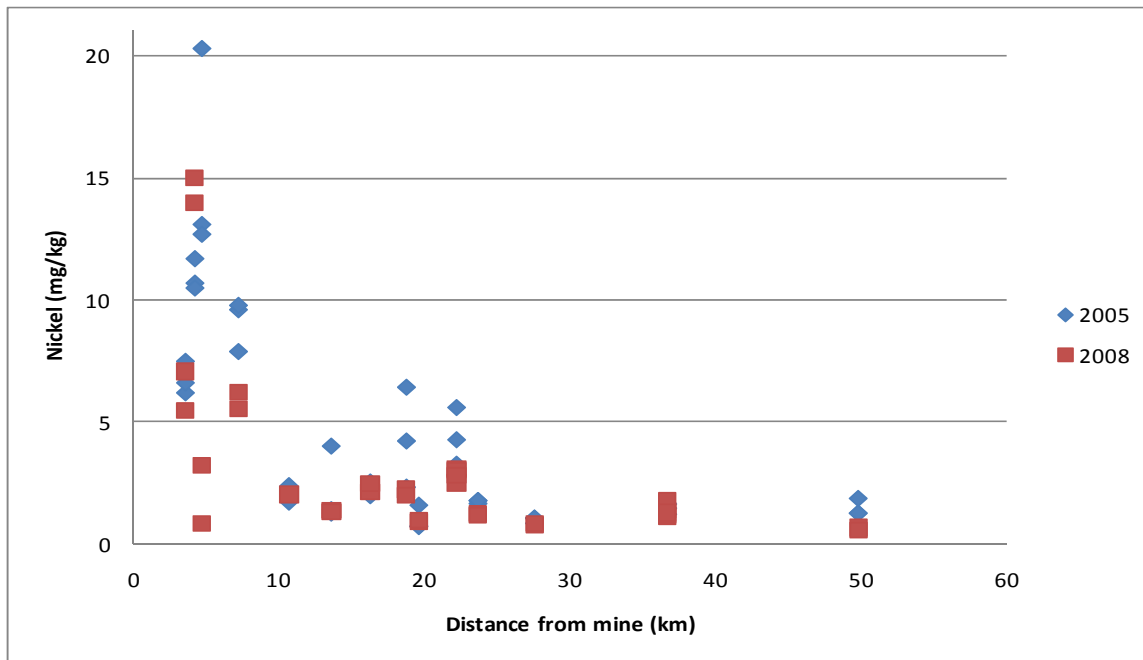


Figure 12. Concentrations of Nickel (Ni, mg/kg) in lichen tissues in 2005 and 2008 according to the distance from the mine

The differences in element concentrations for all elements between years and among plots were tested by unbalanced two-ways ANOVAs. Most ANOVAs show statistically significant differences in element concentrations between AQ locations and between years. These results are presented in Table 3, below.



Table 3. Significant year or site effects produced by the ANOVAs for all elements tested.

Element	Significant Effects	
	Year	Site
Al	F=47.6, p=0.0001	F=66.7, p=0.0001
As	F=238, p=0.0001	F=36.1, p=0.0001
Ba	--	F=33.3, p=0.0001
Cd	--	F=7.8, p=0.0001
Ca	--	F=15.5, p=0.0001
Cr	F=13.8, p=0.0009	F=11.7, p=0.0001
Co	F=16.35, p=0.0002	F=116.5, p=0.0001
Cu	F=44, p=0.0001	F=63, p=0.0001
Pb	--	F=38.8, p=0.0001
Li	F=35, p=0.0001	F=30, p=0.0001
Mg	F=21.5, p=0.0001	F=85.7, p=0.0001
Mn	F=7.2, p=0.01	F=24.5, p=0.0001
Hg	F=50, p=0.0001	F=4.92, p=0.0001
Mo	F=44, p=0.0001	F=17.5, p=0.0001
Ni	F=26, p=0.0001	F=47.5, p=0.0001
Tl	F=8.9, p=0.005	F=24.6, p=0.0001
U	F=60, p=0.0001	F=61, p=0.0001
V	F=89, p=0.0001	F=75, p=0.0001
Zn	--	F=8.9, p=0.0001

Results of the ANOVAs show that differences in element concentrations between years and among sites are, for almost all elements, statistically significant. Indeed, for only five elements (Ba, Cd, Ca, Pb, Zn), differences in element concentrations were not statistically significant between 2005 and 2008. All elements showed differences in average concentrations that were statistically significant among sites. These differences may mostly be due to a typical decline in dust accumulation with distance from the mine site, very commonly observed in the literature. There are also outlier sites with high concentrations of specific elements from the two sample periods which may indicate variation in dust chemical composition, effects of roads and secondary on outlier points such as AQ 116, and AQ 55. In general, however, the effect of dust control and decline of elemental concentration is evident in the data.

The PCA performed on the average concentrations of all variable elements in each year gives some insight into how element concentrations vary by site. In the diagram presented below (Figure 13), the black arrows represent the element concentrations while the blue symbols are a combination of site and year of sampling (e.g. symbol 4.2005 stands for the site 4 sampled in 2005). As scaling is of type 1, the Euclidian distances are approximated in the diagram, which means that the closest two sites are from one another, the more similar they are in terms of their element concentrations. Also, projecting the sites at a right angle onto the vectors of element concentrations approximates their concentration of such elements.



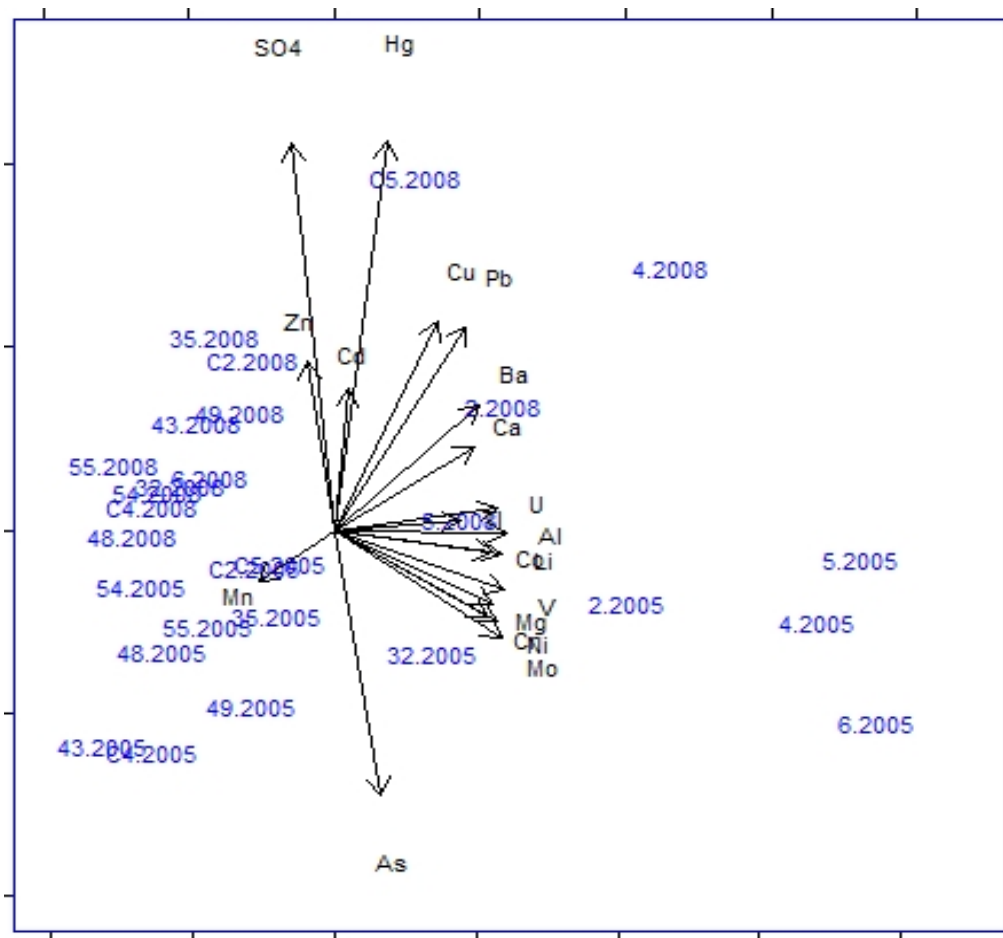


Figure 13. Ordination diagram of the PCA performed on average element concentrations at each of the 14 common sites in 2005 and 2008. Axis 1 represents 53% of the variation of the whole data set while axis 2 accounts for 12%.

The diagram of Figure 13 shows that some sites cluster together in different portions of the diagram. Years of sampling also seem to be segregated, with the sites sampled in 2008 at the top of the diagram, and the sites sampled in 2005 at the bottom. One main element that seems to separate the years of sampling is arsenic, a volatile and labile metal. For example sites 55, 48, 49, 32, 43 and C4 especially yield high concentrations of As in 2005. Mn concentrations also clusters together for some sites in 2005 (C2, C5, 35, 54, 55, 48). However, sites 2, 4, 5 and 6 sampled in 2005 seem to have higher concentrations of Mo, Cr, Ni, V, Mg, Li, Al, U and Co. In general, the diagram suggests that most sites had higher concentrations of most elements in 2005 compared to 2008. In 2008, only sites 35, C2, 49, 43 and 55 showed high concentrations of Zn, Cd and Hg.



Some sites, such as 54 and 55 (on the left side of the diagram) did not show much variation between years. This is very likely because they are far enough away from dust sources that they represent a true background value. They still present similar concentrations of elements. AQ site 4 also showed little variation, possibly because it is close to dust sources that may not have changed much over the period from 2005 to 2008. These three sites are all found on the west side of the mine (Figure 1). Other sites however showed different behaviour over time, as expressed by their different location in the ordination. Sites 6 and 32 for example had high concentrations of most elements in 2005 (they are located on the bottom right side of the diagram), but showed lower concentrations in 2008 (they are then located around the middle-left of the diagram). Again, dust control may be the reason for this trend.

It is also notable that lichens sampled in AQ locations near the northern shore of Lac du Grass showed no dramatic changes in element concentrations and generally had concentrations near background levels, suggesting that dust dispersal from Diavik Mine to the southeast is not influencing the patterns in dust accumulation in lichens from EKATI Mine.

4.3 Comparison between elements in lichens and dust fall

Lichen elemental concentrations are very useful for showing overall dust distribution from sources in much larger areas than dust fall collection and the concentration in lichens usually closely resembles the data from dust fall collectors maximum concentrations (Bargagli and Mikhailova 2002). Dust fall concentrations of elements and element concentrations in lichen tissues were compared for seven sites that had both sets of data available. The dust fall sites used in the analyses, as well as the corresponding sites for which lichen tissues were analyzed, are presented in Table 4.

Data from sites FOX-U30, D30 and D90 were averaged to compare to lichen site AQ-19, as they were located physically very close to one another.

Table 4. Sites where element concentrations were available for dust fall and lichen tissues.

Sites with dust fall element concentrations	Corresponding sites with element concentrations for lichens
AQ-49	AQ-49
AQ-54	AQ-54
LLCF-PA	AQ-5
LLCF-PB	AQ-31
AIR-280	AQ-29
FOX-U30/D30/D90	AQ-19
FOX-D1000	AQ-4

The same elements as presented in Table 4 (above) were compared between dust fall and lichen tissues in 2008. Different relationships seemed to occur for different



elements; however, the data clearly shows that for most elements, a high concentration in lichens is accompanied by a high concentration of the same elements in dust. This was true for Sulphur, and the crustal elements Al, Ba, Cd, Ca, Co, Pb, Mg, Mo, Ni and Sr. For Al, Ba, Co, Pb, Mg and Ni, the site AQ-19 was an outlier, however. At that site, the concentrations in lichen tissues were relatively small compared to high concentrations of elements in dust fall. This may be due to topographical sheltering of the lichens and higher exposure of the dust fall collection near AQ 19. Figure 14 shows an example for Al. Concentrations of Cd at site AQ-5 and concentrations of Ca at site AQ-49 were also atypical in the same fashion (low lichen concentrations for relatively high dust fall concentrations). These differences are most likely due to dust fall monitors being placed conservatively, near dust sources such as road, whereas lichen monitoring sites have a tendency to be located at distances from roads, in less impacted microsites.

Other elements, such as Cu, Li, Hg and Zn, as well as N, also showed a positive relationship between lichen and dust fall concentrations. These were less linear and more exponential (see Figure 15 for Cu) and possibly indicate passive uptake by lichens.

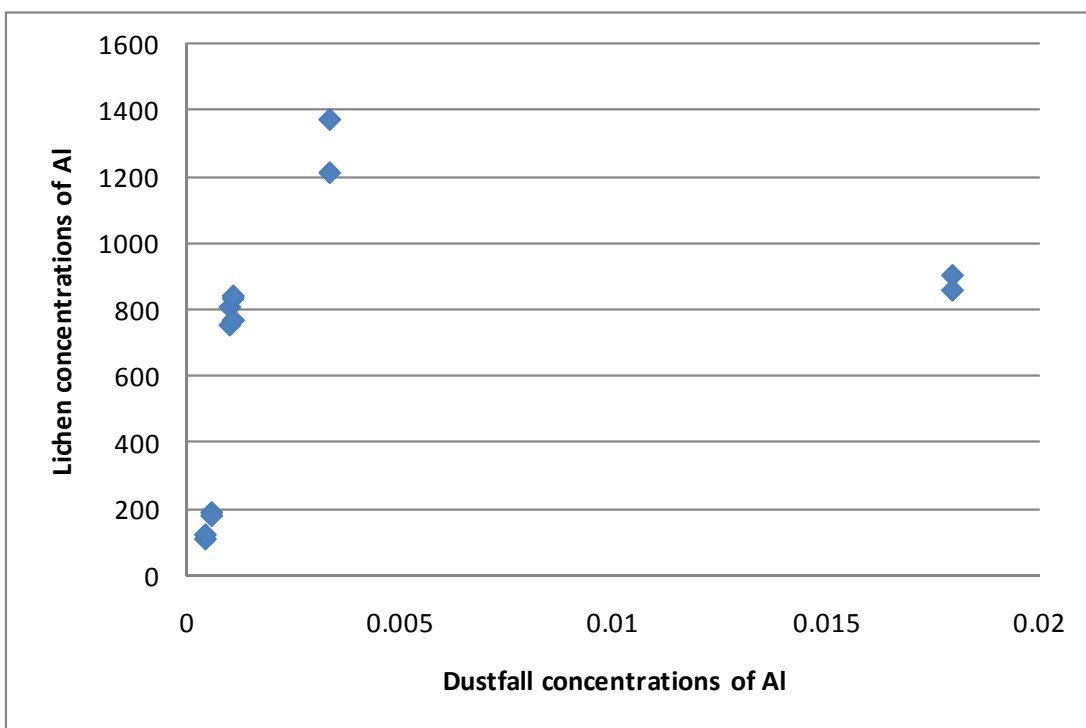


Figure 14. Concentrations of Al (mg/kg) in lichen tissues compared to concentrations of Al in dust fall around the EKATI mine.



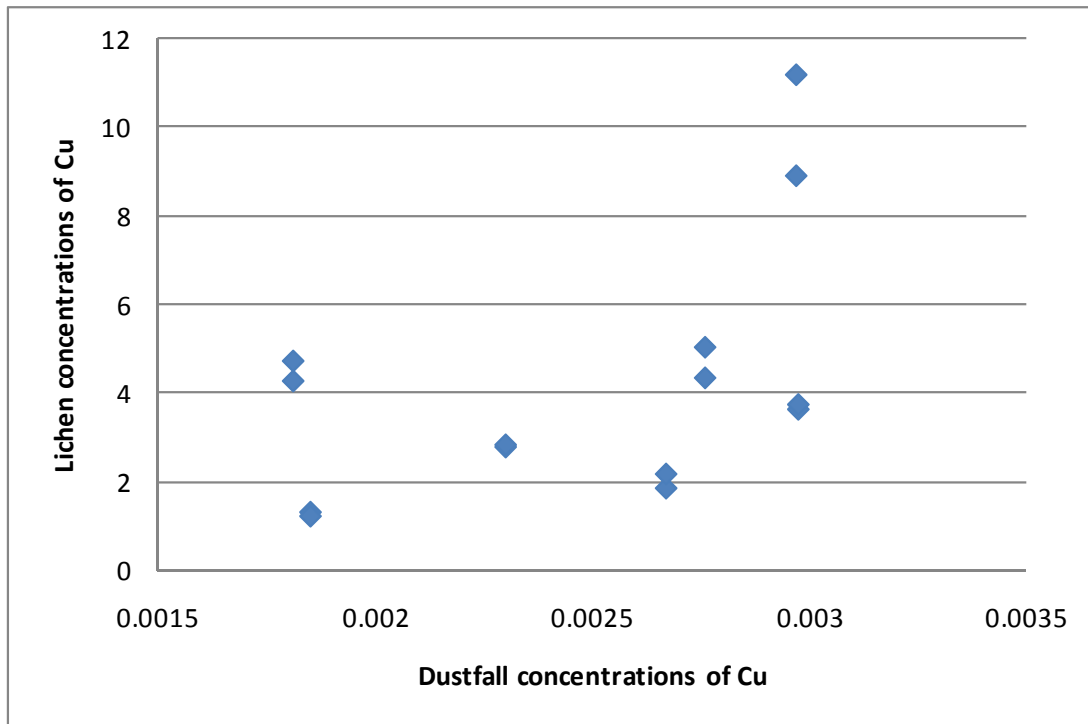


Figure 15. Concentrations of Cu (mg/kg) in lichen tissues compared to concentrations of Cu in dust fall around the EKATI mine.

Concentrations of Mn in lichens seemed to decline with an increase of Mn in dust fall, as shown in Figure 16. The site AQ-19 was an outlier with high values of Mn in dust fall.

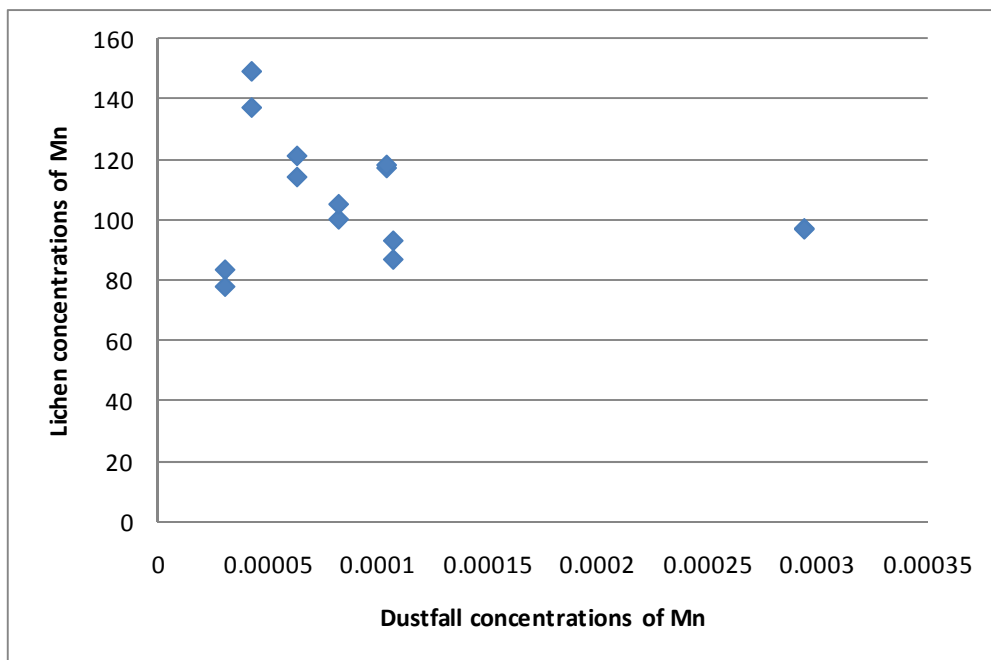


Figure 16. Concentrations of Mn (mg/kg) in lichen tissues compared to concentrations of Mn in dust fall around the EKATI mine.



Five elements (As, Cr, Ti, U and V) did not show any relationships between concentrations in lichen tissues and in dust fall, mainly because these elements did not vary in the dust fall among sites.

An RDA (redundancy analysis) was performed next to assess which elements recorded in the dust fall seemed to influence the uptake of elements by *Flavocetraria cucullata* at nearby sites. All elements in the lichen tissues were included in the RDA, and all elements that showed variation among sites in dust fall (thus As, Cr, Ti, U and V were excluded).

The forward selection of the independent variables (the concentrations of elements in the dust fall) performed with 99999 permutations kept only two variables in the model, at $\alpha = 0.05$: Zn and Sulphur. According to the results of the RDA, these two variables alone explained 40% of the variation of all elements concentrations in lichens ($R^2_{aj} = 0.40$, $p = 0.0024$). Sulphur is an emitted substance in vehicle exhaust, and Zn is a common and abundant crustal element with high variation in the dust originating from dirt roads, therefore road side dust and particulate deposition is possibly the main reason for the strength of the relationship between S, Zn concentrations in dust and the elements in lichen. These results are consistent with other studies where plants are used to indicate the dispersal of dust from road side edges or other dust sources (Clarke et al., 1996; Auerbach et al. 1997).

The ordination diagram of the RDA is presented in Figure 17. The scaling of the ordination was of type 2, which means that the correlations between the variables are approximated by their angles in the diagram (Legendre and Legendre 1998); in other words, the smaller the angles are, the more correlated the variables are. The blue vectors represent the concentrations of Zn and SO₄ in the dust fall, and the red vectors stand for the elements concentrations in *Flavocetraria cucullata* tissues.



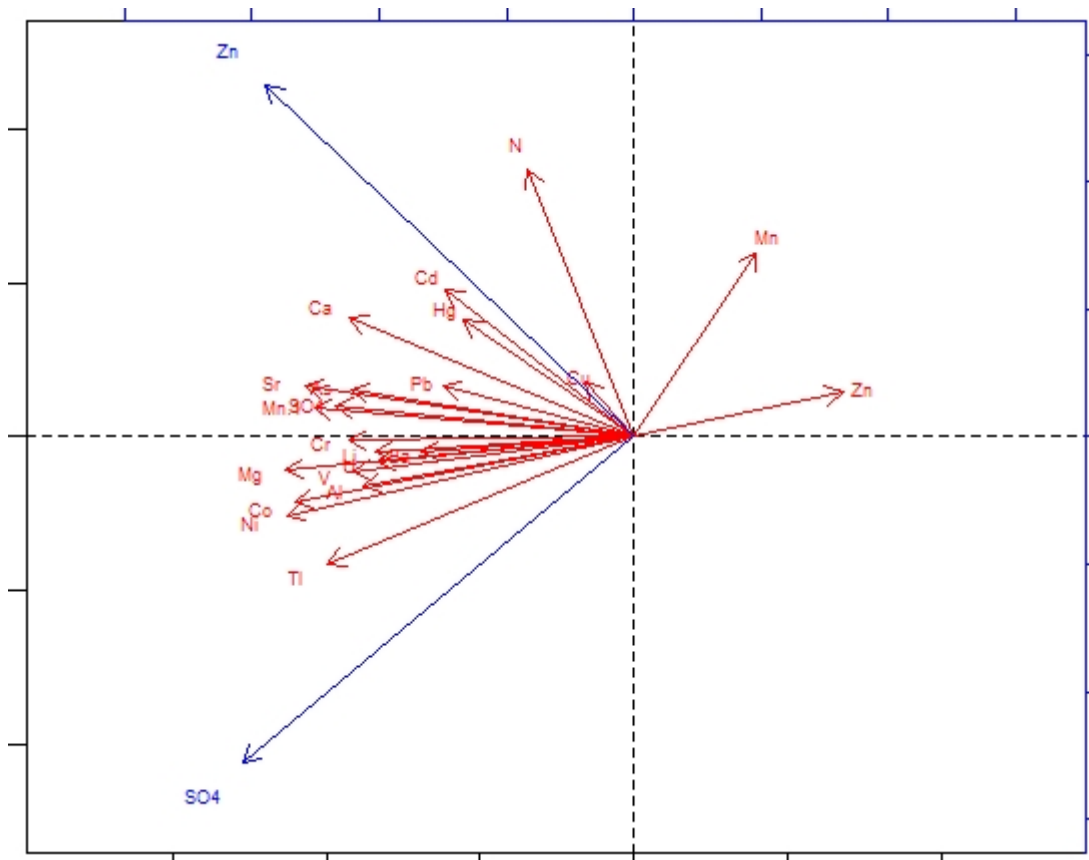


Figure 17. Ordination diagram produced by RDA (scaling of type 2). Axis 1 expresses 44% and axis 2, 6% of the total variation in element concentrations in lichens. The blue vectors are concentrations in the dust fall and the red vectors are concentrations in lichen tissues.

Results of the RDA suggest that concentrations of Zn and S in dustfall have links to the element concentrations in lichens tissues. Concentrations of Zn in dust fall are positively linked to the concentrations in lichen of Mn, Sr, As, Pb, Ca, Hg, Cd, Cu and N, as well as the concentrations of S. That suggests that an increase in Zn concentrations in lichen tissues is a reasonable marker for increased dust effects to vegetation near EKATI Mine. Also S concentrations in dust fall were positively associated to concentrations of Cr, Li, U, V, Mg, Co, Ni, Ti, Al and Ba in lichen tissues, and negatively linked to Mn and Zn. It may be possible to distinguish the difference between exhaust 'signatures', i.e. sulphate particulate and crustal elements originating from average dust 'signatures' using these data.



4.4 Comparison between elements in lichens and snow melt water

The relationship between snow water element concentrations and lichen or moss uptake is frequently used as a way of examining the patterns of dust dispersion from point sources (Walker et al. 2003; Richardson, 1988; Beck and Ramelow, 1990; Tomassini et al. 1976). Snow measurements represent a conservative and maximum measurement of accumulated particulate in winter (Reimann et al. 1995, Bales et al. 1993; Cheng et al. 1993; Walker et al., 2003a), whereas concentrations of elements in lichens are an accurate measurement of longer-term depositional / exposure patterns of particulate matter of gasses, whether its from snow melt water or dry deposition / gas exposure (Bargagli and Nimis, 2002). Source apportionment between road dust and emissions from exhaust, dust plume drift from construction, and emissions from industrial roasting / smelting of metals and fluoride, coal-fired plants and fertilizer plants have all been characterized using a combination of snow water chemistry and lichen or moss uptake (France and Coquery, 1996; Walker et al. 2003). The relationship between elemental concentrations in water or tissue and distance from sources is often interpreted as a signature for a particular emission or dispersed substance. Concentrations and the change in ratios over time of elements are also used to define the extent to which dust is dispersed versus long range transport or geogenic (bedrock) sources (Walker et al. 2003a). In 2008, the elemental concentrations in lichen tissues (*Flavocetraria cucullata*) from 32 sites near the Ekati Mine were compared to the concentration of the same elements in snow water samples.

The data from snow and lichen measurements made in 2008 indicate that relationship between some elemental concentrations in snow water and lichen tissue is relatively strong, while some relationships are not as strong. Examples of both strong and weak relationships are provided in Figures 18 through 21, below.

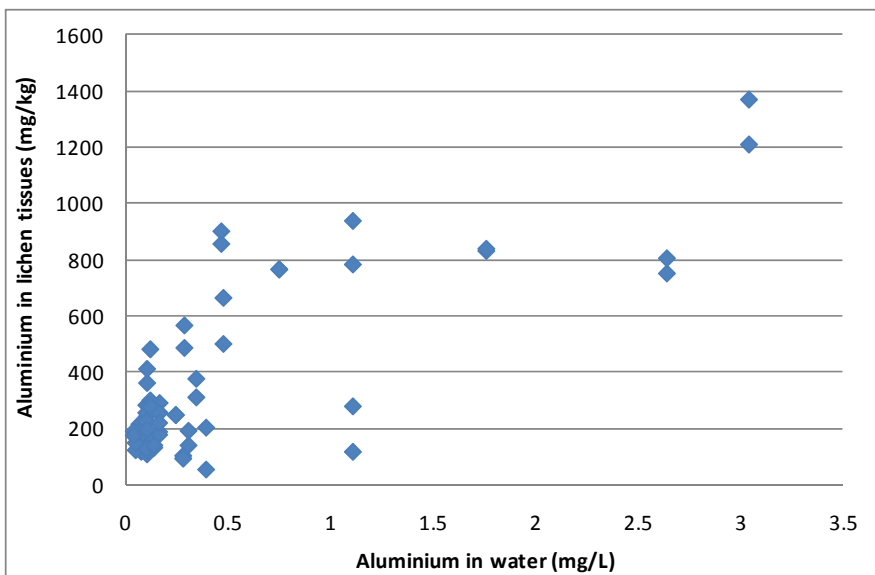


Figure 18. Aluminum in lichen tissue in relation to aluminum in snow water near the Ekati Diamond Mine; a strong relationship.



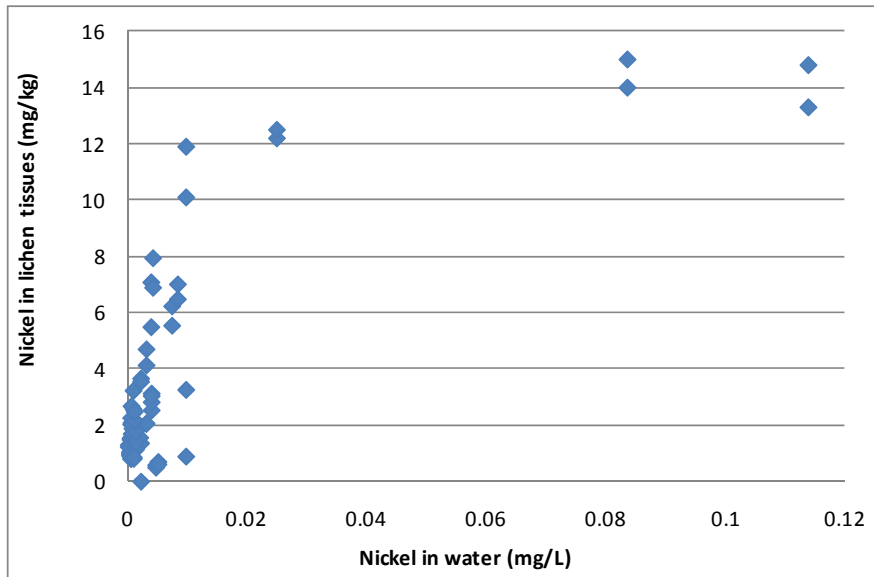


Figure 19. Nickel lichen tissue in relation to nickel in snow water near the Ekati Diamond Mine; a strong relationship.

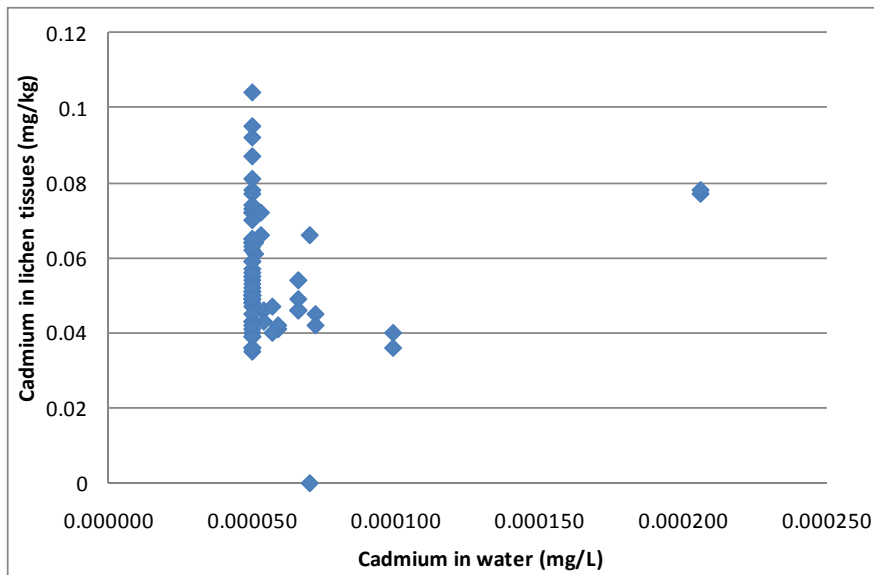


Figure 20. Cadmium in lichen tissue in relation to cadmium in snow water near the Ekati Diamond Mine; a relatively weak and bimodal relationship due to concentration. Detection limits were 0.0010; concentrations below detection limits were expressed as half the detection limits.



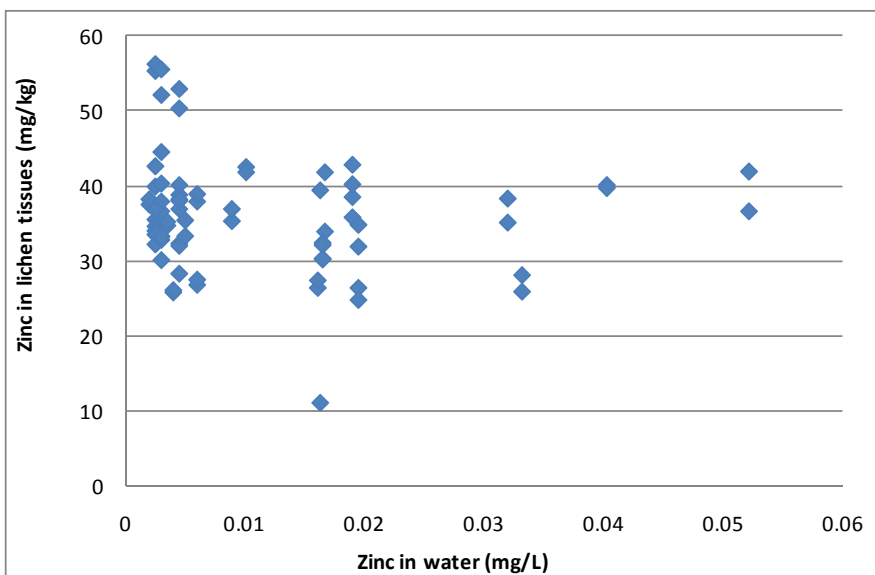


Figure 21. Zinc in lichen tissue in relation to cadmium in snow water near the Ekati Diamond Mine; a relatively weak relationship.

As seen in the figures above (and in more detail in Appendix 1), some of the elements associated with road dust in meltwater decline over distance from Ekati, and some elements do not show much of a relationship with distance (Rescan 2009). A weak or non-existent relationship with distance is an indication that the element in question is not a major component of dust or emissions from the mine, and may be influenced more by background geogenic (rock or local soil) sources, or from long range transport (Walker et al. 2003a). Figure 3, above, (Cadmium) illustrates the effects of low level long range transport of cadmium, a “multi-hop” metal, which has re-volatilized from both local and long range transport sources in the Subarctic and Arctic (Cheng et al. 1993).

The following elements may be enhanced due to Ekati sources; $Al > Ni > Sr > U > Mg >> Pb > Cu > Cr > Co$. The order of the importance is estimated and based on an interpretation of the distributions. Elements with either a non-relationship or a vague relationship with distance from the Ekati mine site include Mn, Zn, As, N, sulphate and pH in snow. These data indicate that most of the elements show a distance relationship that is typical earth crustal road dust-born elements such as aluminum, barium, magnesium, strontium, and others are associated with mineral rich ores such as copper and nickel (usually is associated with cobalt), and uranium (often associated with barium). These latter elements may be elevated due to dust from the mine and roads. It should be stressed the concentrations of most elements in water and tissue are very low, and not associated with toxicity.

When examining the graphs above, it is important to recognize that snow meltwater elemental concentrations are a function of both dust and emissions from local sources, but also from long range transport and geogenic inputs, both of which can be substantial in the Subarctic and Arctic environments (Walker et al. 2003; Cheng et al., 1993; Kozac et al. 1990; Gytarsky et al. 1995; Franzen et al. 1994). Although elemental concentrations in water overall were low in comparison to more developed sites in the Arctic, the data show that slightly elevated elemental concentrations in snow water were accompanied by elevated concentrations of the same elements in lichen tissue from paired AQ sites.



Sites AQ-5 and AQ-29, however, were outliers for several elemental concentrations in snow water. These sites are close to the roads leading south of the mine and likely receive road dust prior to the snow sample period. However, the elemental concentrations in lichen tissue from these sites were lower in relation to most of the other AQ sites. The lichens were collected over a larger area than the snow samples and included tissues from areas outside the highest dust depositional boundaries adjacent to roads. The deposition gradient from road edges declines over relatively predictable distances depending on the character of the road surface materials (Viskari et al. 1997; Rogge et al., 1993).

Some distributions of elevated concentrations in relation to increases of the same elements in water were bimodal, with two peaks in concentrations in lichen tissues. Figure 22 is an example; where sulphate concentrations in lichens have two basic patterns; enhancement near the mine site and also, enhancement at distances from the mine site. Cadmium also shows a bimodal distribution.

There is an apparent relationship between concentrations of cobalt, magnesium, nickel and strontium in lichen tissues, where concentrations increased in a non-linear fashion with the concentrations of the same metals in water samples (see Figure 23 for an example with magnesium). Concentrations of magnesium, strontium and nickel in lichen tissues and water were more linear when the outliers were taken out, however (Appendix 1). The occurrence of non-linear distributions, and outliers in the water and lichen data set are not anomalous; they are mostly an indication of overarching effects of either geogenic or long range transport sources causing dust accumulation, or both.

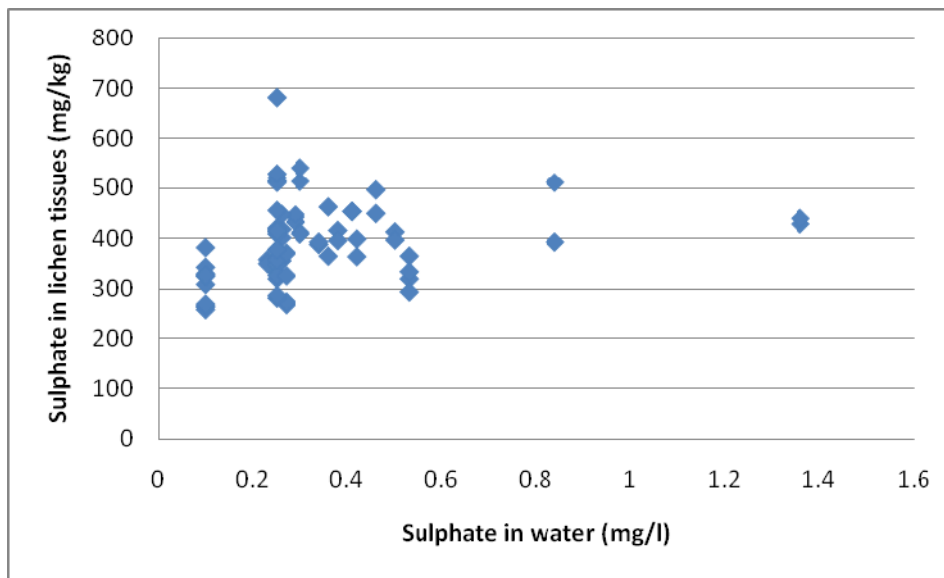


Figure 22. Sulphate in lichen tissue in relation to sulphate in snow water near the Ekati Diamond Mine



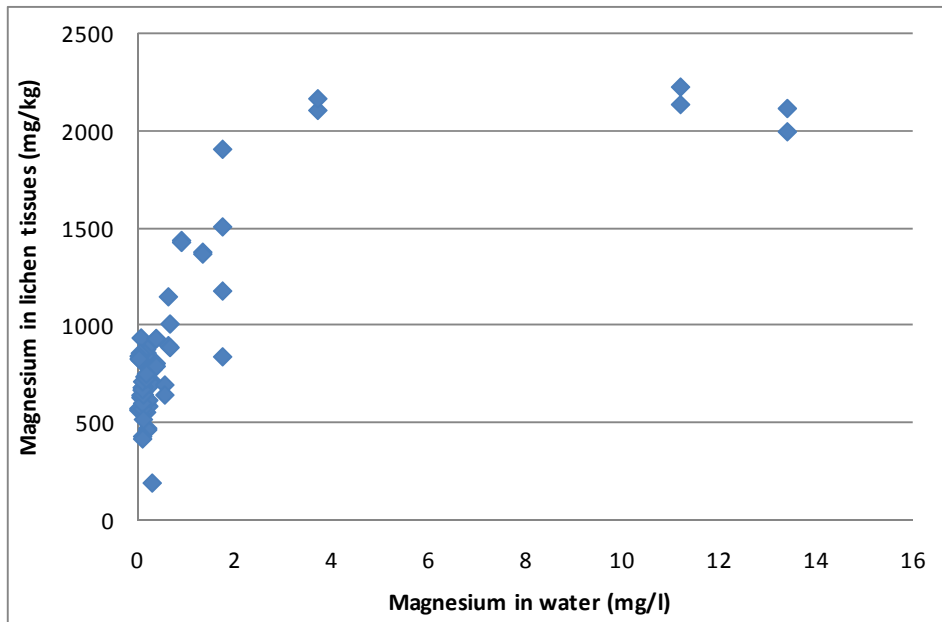


Figure 23. Magnesium in lichen tissue in relation to magnesium in snow water near the Ekati Diamond Mine

In order to see if Ekati has an influence on local or regional snow water pH the regression of snow water pH against the independent variables sulphate, nitrate, nitrite and total N were performed. For pH *versus* sulphate (Figure 24), there is a significant regression ($y = 0.827x + 5.2121$) with $r^2 = 0.3134$, $p < 0.001$. For pH *versus* Nitrate (Figure 25), there is not a statistically significant regression ($p > 0.01$). Neither the nitrite ($p > 0.01$) nor the total Kjeldahl-N vs pH ($p > 0.01$) have a significant regression (Appendix 2). This is an indication of slight, localized sulphate loading, but long range transport of sulphate is also evident.

No strong relationships were found between element concentrations in lichen tissues and water samples for total nitrogen, when outlier data points were retained. The relationship between lichen N concentrations and snow water is usually very strong and related to both dry and wet deposition, if a significant source of N is nearby (Walker et al. 2003b; Söchting, 1995; Hyvärinen and Crittenden, 1998; Bruteig, 1993). There are no localized trends in acidifying effects of NO_x indicating local sources are not significant.

These data indicate that sulphate particulate has an influence on water pH, but the non-linear distribution in the lichen concentrations indicates that long range transport sources of sulphate particulate are also important. This has been supported in the literature on source apportionment in the subarctic and arctic, as influenced by arctic haze, which was noted in the August of 2008 sample period. Sulphate and metal loading is known to be a significant source of acidification and metals accumulation in the Canadian Arctic (Reimann et al. 1995; Quinn et al. 2007; Cheng et al. 1993). Nitrification and subsequent acidification is not as pronounced but does occur (Quinn et al., 2007). These data support the conclusion that both small, localized effects from vehicular traffic at Ekati and the effects of long range transport are evident.



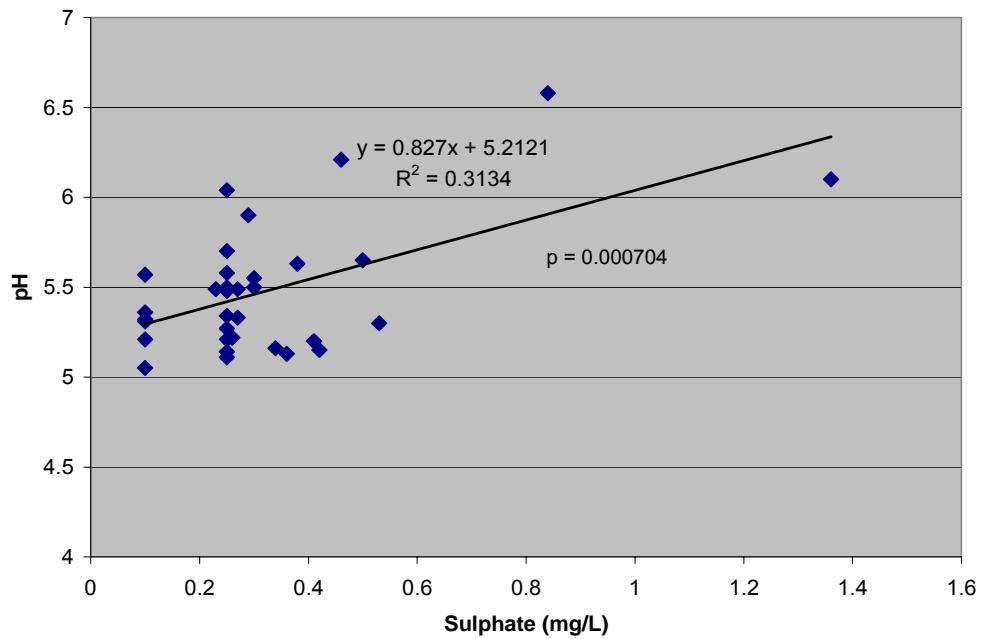


Figure 24. The influence of sulphate on snow water pH near the Ekati Diamond Mine.

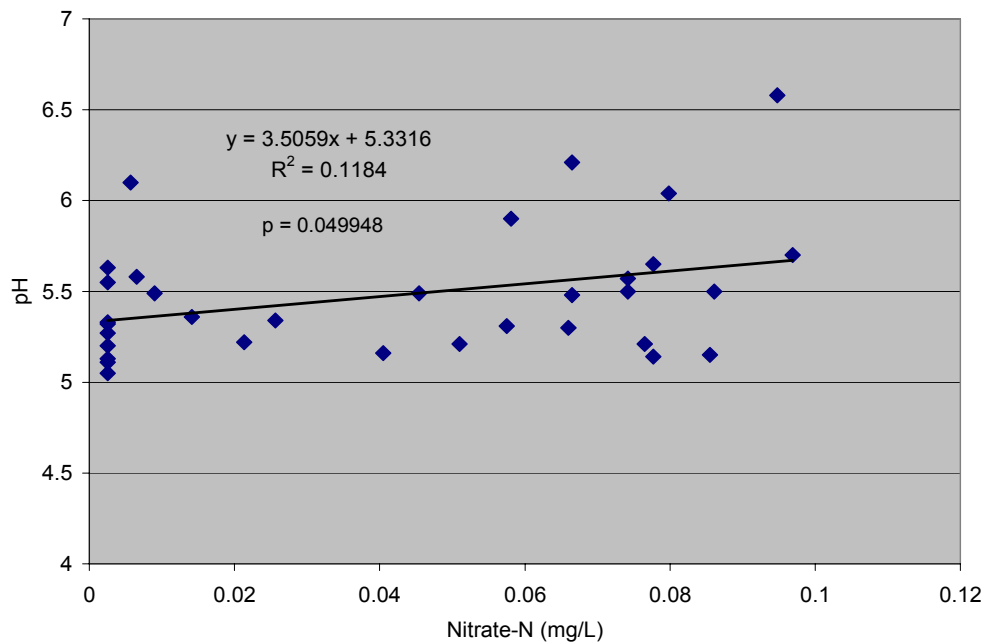


Figure 25. The influence of nitrate on snow water pH near the Ekati Diamond Mine.



In order to determine if a specific signature for Ekati mine could be derived from the snow water and lichen data, an RDA (redundancy analysis) was performed (Figure 26). As *Flavocetraria cucullata* lichen is responsive to overall long range transport and to localized sources, the patterns in uptake are indicative of source apportionment, providing the sample area is large enough to show where localized effects from Ekati decline and long range or geogenic influences co-occur or exceed localized sources.

The forward selection of the independent variables (the concentrations of elements in the water samples, plus distance from nearest source of metals, pH, days with snow and the geographic coordinates) performed with 99999 permutations kept only four variables in the model, at $\alpha = 0.05$: pH, distance from nearest source, the X geographic coordinate and concentrations of Vanadium (V) in water. According to the results of the RDA, these four variables alone explained 45% of the variation of all elements concentrations in lichens ($R^2_{aj} = 0.45$, $p = 0.00001$). Vanadium concentrations in lichens were also found to show a pattern in relation to the Ekati mine site in the 2005 study, and are evident in Kidd et al. (2003).

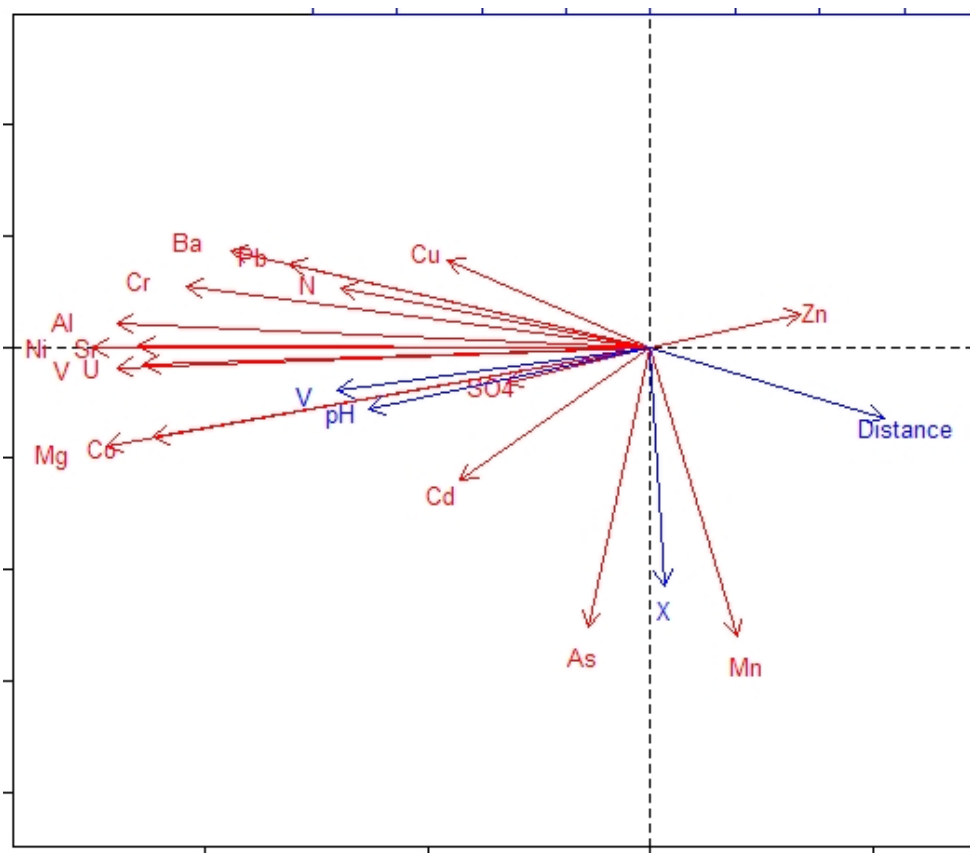


Figure 26. Ordination diagram produced by RDA (scaling of type 2). Axis 1 expresses 45% and axis 2, 4% of the total variation in element concentrations in lichens. The blue vectors are independent variables and the red vectors are concentrations in lichen tissues.



In the ordination diagram of the RDA (Figure 26; above) the scaling of the ordination was of type 2, which means that the correlations between the variables are approximated by their angles in the diagram (Legendre and Legendre 1998); in other words, the smaller the angles are, the more correlated the variables are. The blue vectors represent the independent variables selected by forward selection and the red vectors stand for the elements concentrations in lichen tissues.

Results of the RDA suggest that concentrations of V and pH in water samples have links to most element concentrations in lichens tissues. Concentrations of V are positively linked to the concentrations in lichen of SO₄, Mg, Co, U, V, Sr, Ni, Al, Cr, N, Pb, BA and Cu. The concentrations of all these elements were also negatively associated with the distance from the nearest source, which means that their concentrations increased close to sources of metals in water. The concentrations of zinc in lichen tissues however increased along with an increase in distance from sources; zinc is highly variable in soils and relatively mobile. It usually varies over long distances. Finally, concentrations of As and Mn increased further North of the study area. The concentrations of As and Mn are both associated with Arctic haze (Walker et al. 2003a; Cheng et al. 1993).

In their characterization of Arctic loading from trans-boreal sources, Cheng et al. (1993) indicate that lead, cadmium, sulphate, vanadium and nickel have significant sources with transport to the Canadian Arctic as both winter deposition and summer haze. Also concentrations of some elements in lichen tissues, which are very sensitive to even minute differences in elemental concentration in dust or gas are so low as to be reported as half the detection limit from the analysis, and therefore have no link with Ekati as a source. The elements with a decline in concentration over distance in both snow water and lichen are associated with Ekati Mine, and appear to have originated mainly from dust, with relatively small emissions of sulphur compounds occurring in the signature. Vanadium in particular, although low in concentration, appears to be a signature substance for Ekati and could possibly be used in ratios to distinguish Ekati from other sources.



5.0 Conclusions

Elemental concentrations in the two indicator lichens collected in 37 Air Quality locations in a large area around the EKATI Mine indicate the influence of dust from the mine is confined to a relatively small area around the mine site, mainly to the south of the main mine buildings, but that long range transport is likely influencing S and N concentration in lichens. The snow meltwater analysis supports the findings of the dust analysis with some variation. Snow meltwater is an indication of a single winters accumulation whereas lichens show trends over a longer period of time. The snow meltwater and dust analysis both indicate most of the nitrogen input is from long range transport. Volatile elements are dispersed further than non-volatile elements, and the patterns of this show in the lichen samples. All concentrations of dustborne elements are primarily influenced by long range transport from prevailing winds, but haze will continue to influence S and N concentrations. Therefore it will be necessary to monitor changes in concentrations site wise over time, knowing that increases in elements from re-volatilized compounds accumulating in the sub-Arctic will influence accumulation characteristics.

These data indicate that all future monitoring will have to consider the effect of arctic haze on substance accumulation in lichens from sources other than EKATI. Figure 27 and 28 shows haze accumulation on the same day (August 10th, 2008), illustrating how haze accumulated near two AQ locations quite distant from EKATI mine during a forest fire event in northern Alberta.



Figure 27. Yamba Lake, 50 km NE of EKATI, taken 7:35 AM, August 10th, 2008, note sky is overcast, see Figure 19, below.





Figure 28. West of Exeter Lake at approximately 29 km from EKATI mine, taken at 11 AM, August 10th, 2008 (i.e. the photograph was taken two hours later, on the same day as Figure 18: the comparison shows haze caused by forest fire in northern Alberta).

While the crustal element concentrations show no significant trends in south to north concentration increases, the volatile or migratory element concentrations do tend to show the influence of arctic haze. Therefore monitoring in the future should be prepared to explain the difference between volatile elements, long range transport elements, and elements that are part of a specific dust signature.

Although haze effects and secondary sources have to be considered, it was found that the element concentrations in lichens from the EKATI mine monitoring program relate well to the dust fall monitoring that took place in 2008. The dust fall data was more conservative, i.e. more concentrated near dust sources, and not reflective of the drop-off in dispersal of dust from sources, however, which the lichens show. Therefore, both programs are complimentary.

In comparison to dust fall, the lichens tend to show how dust has behaved near the mine site and over a much larger area, for a longer period of time than the short duration dust fall collection. Further, the lichen data shows the effect of dust control over the duration of the biomonitoring program.



Concentration of elements in lichens collected in 2005 were generally higher than in 2008, indicating that past dust concentrations were higher than during the measurement period of 2008.

The lichens showed the effect of earth crustal element dispersal clearly, and also the effects of exhaust and particulate deposition, which is confined to areas near the mine and roads. Most elemental concentrations, even for impacted areas near the EKATI Mine are below established background concentrations, from the literature. The exceptions are for enhanced air quality monitoring locations near the mine, and even those concentrations are below those associated with industrial development. This implies that concentrations are not of concern to managers of barren ground caribou.

6.0 Recommendations

- Monitoring of changes in S, N, Zn and volatile metals should consider referencing information on long range transport.
- Co-location of more distant AQ locations with dust fall monitoring may not be feasible, therefore specific sampling of lichens closer to existing dust fall location should be planned.
- *Flavocetraria cucullata* is very scarce and difficult to sample, as it is heavily browsed and cratered for by barren ground caribou. Therefore larger areas for collections may be necessary. Boundaries of the collection areas should be defined in GIS.
- Relocation of AQ plots that have been impacted by secondary sources may be necessary.
- One or two additional AQ plots should be located to the south of the mine site. Enhancement of element concentrations on either side of a large un-sampled area to the south of the mine indicates that additional samples would allow for construction of isopleths describing dust dispersed elements.
- No further AQ locations are needed (aside from the areas to the south) and at distances from the mine site, and in fact the data indicates that some samples near the mine site are redundant and could be eliminated.



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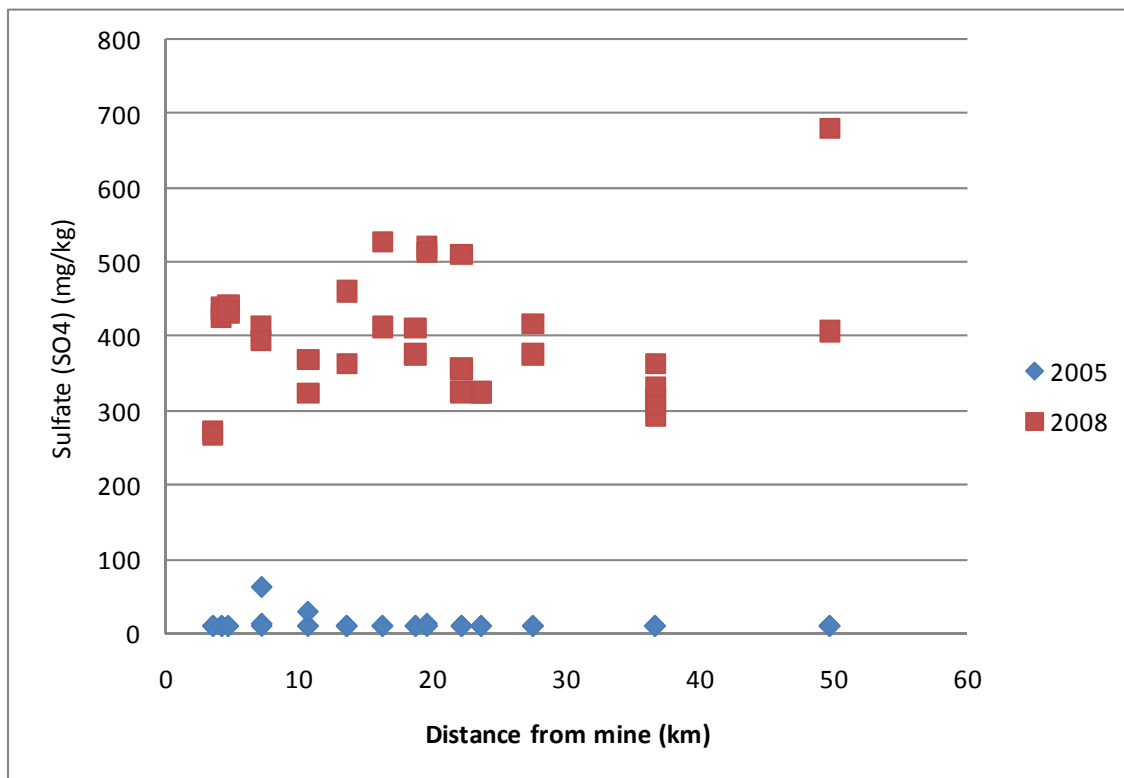
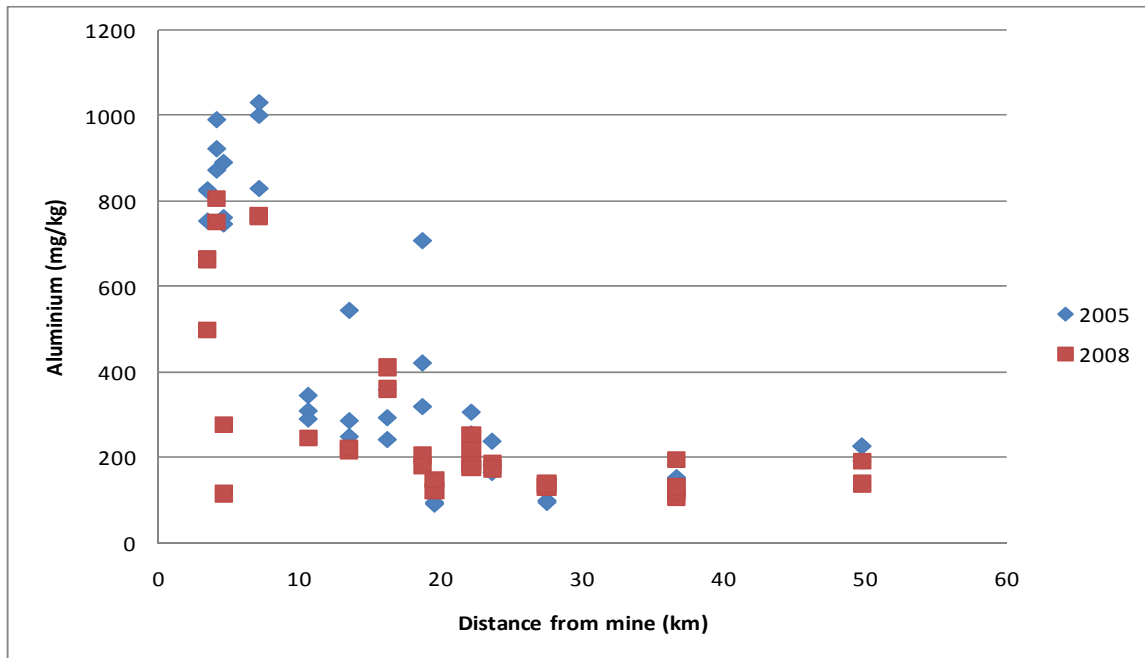
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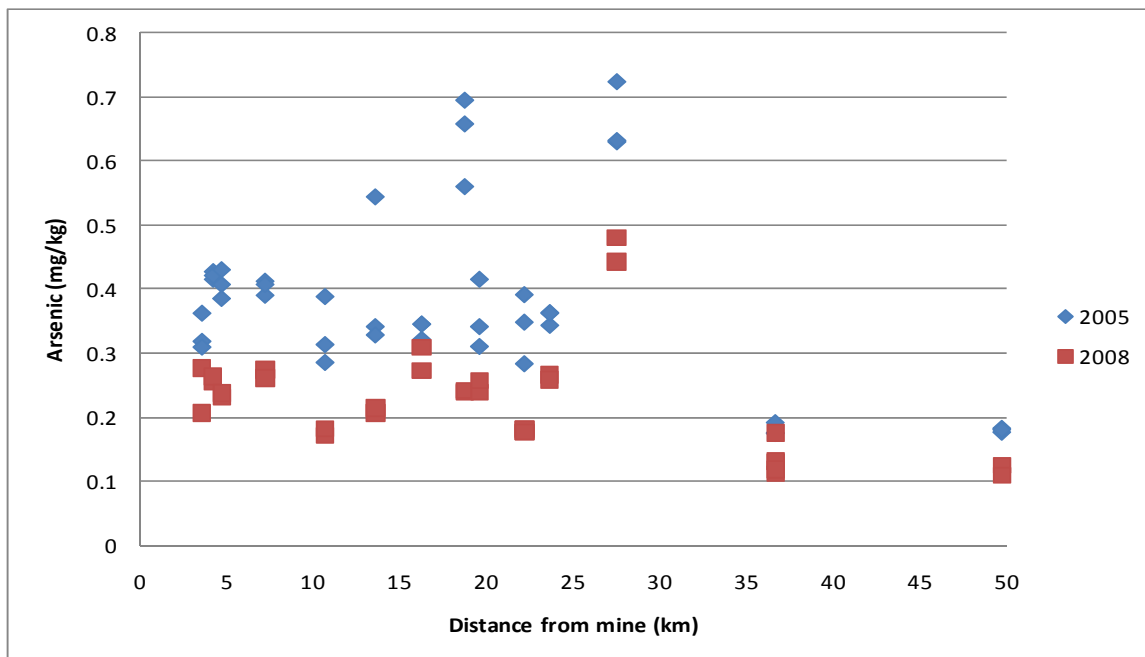
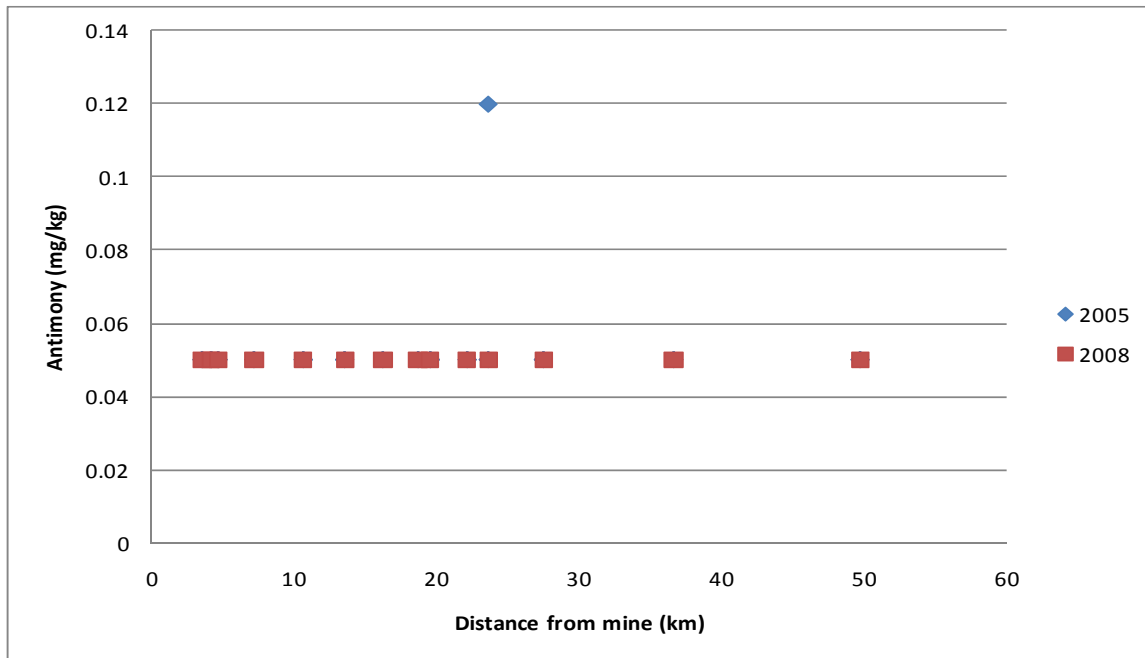


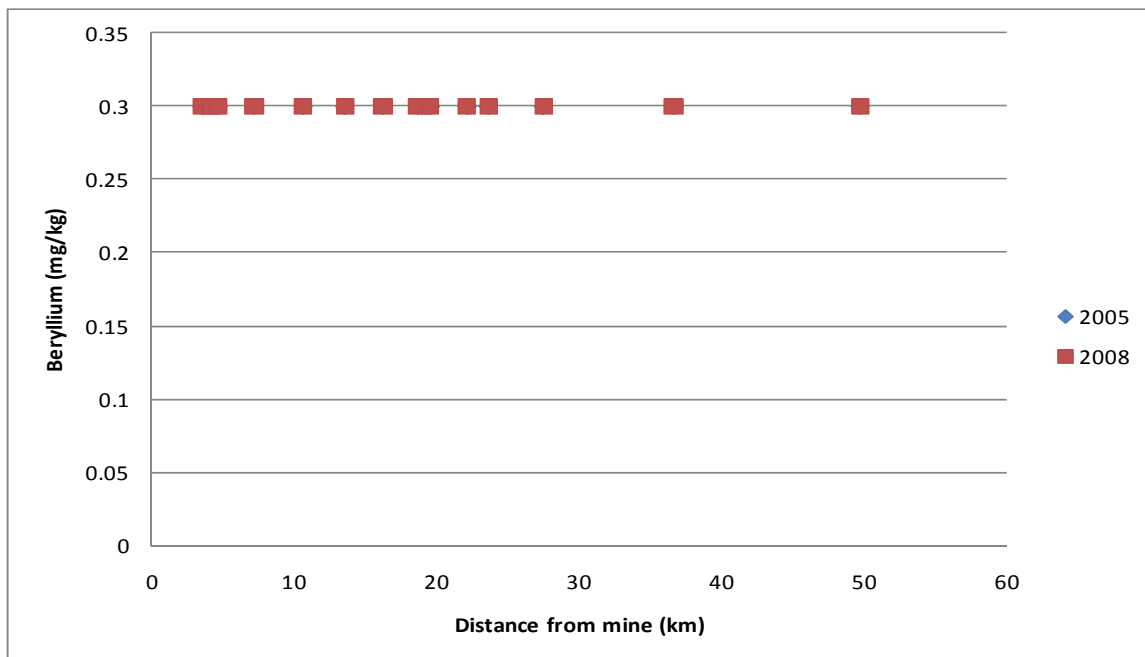
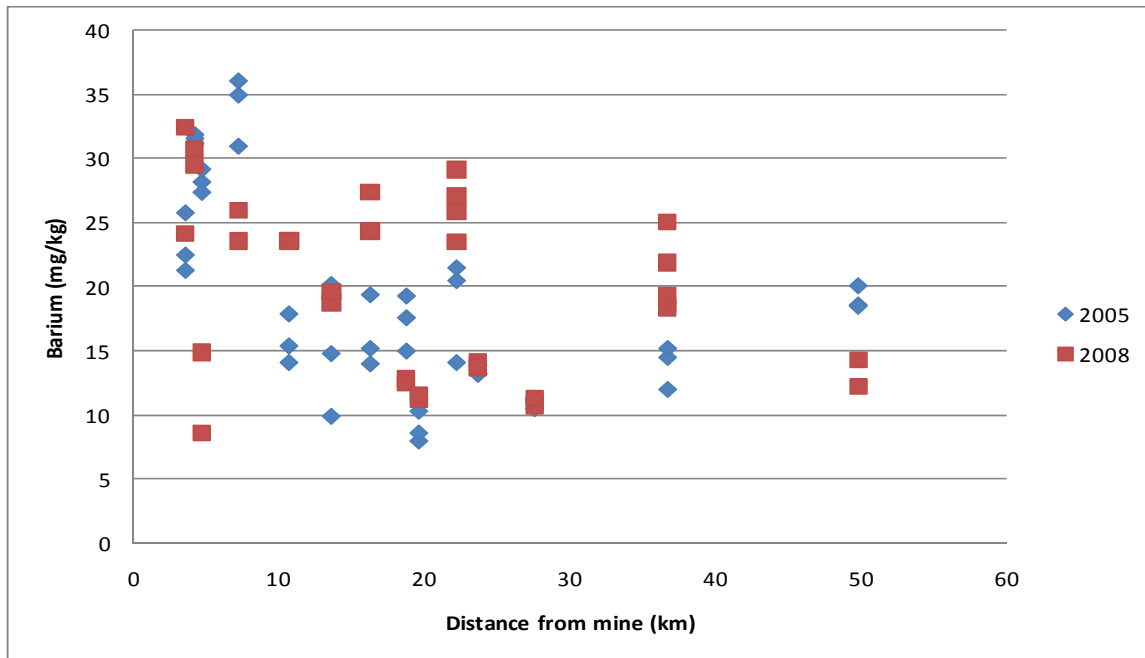


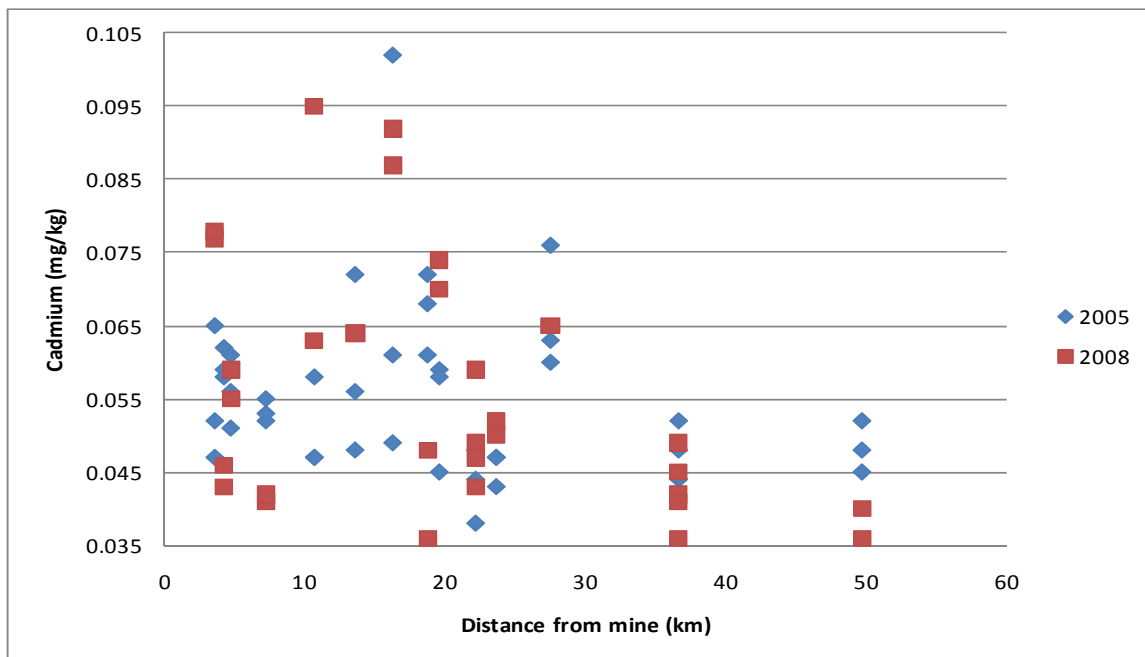
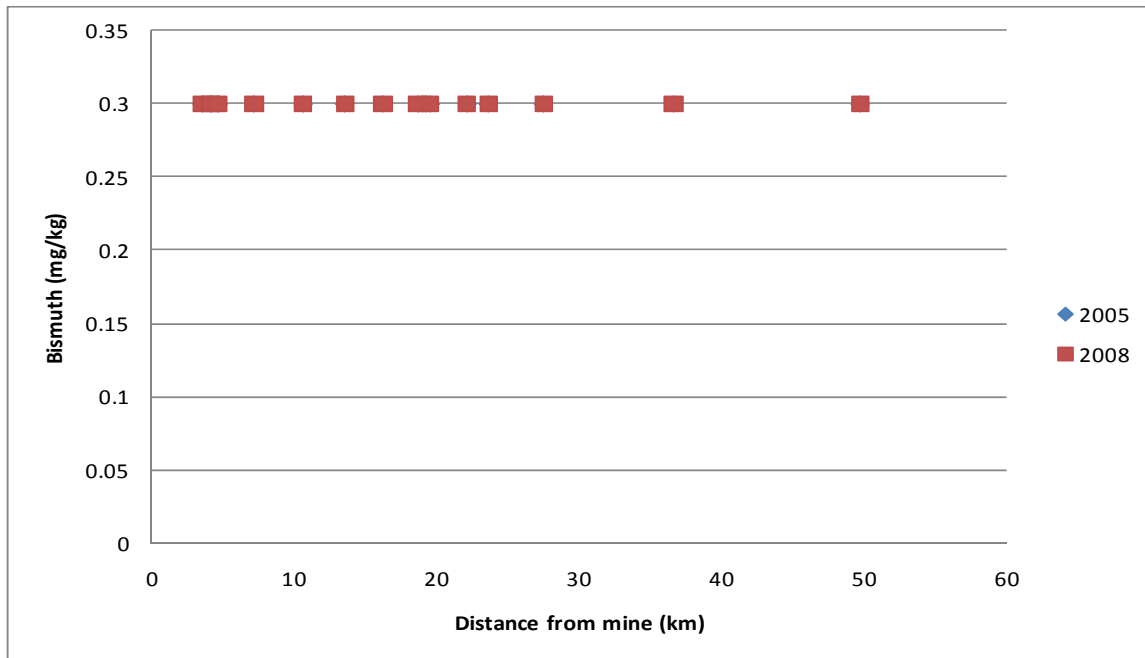
**Appendix 1: Concentration of elements in *Flavocetraria cucullata*
lichens from near EKATI Mine in 2005 and 2008
(some data from 2008 not shown, see Appendix 2).**

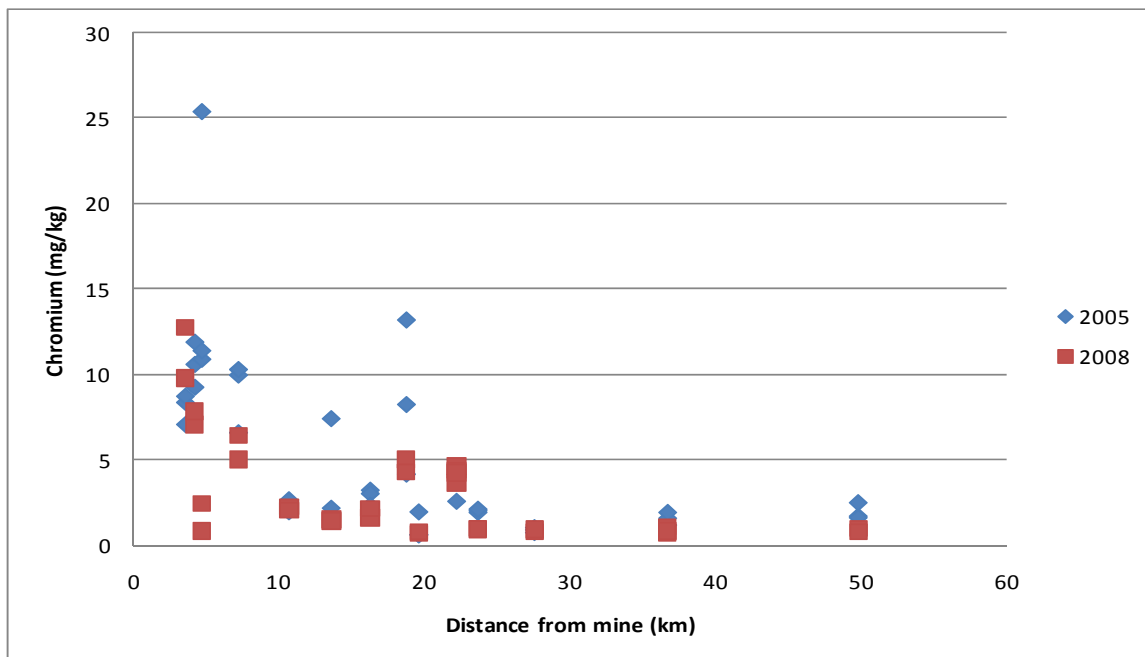
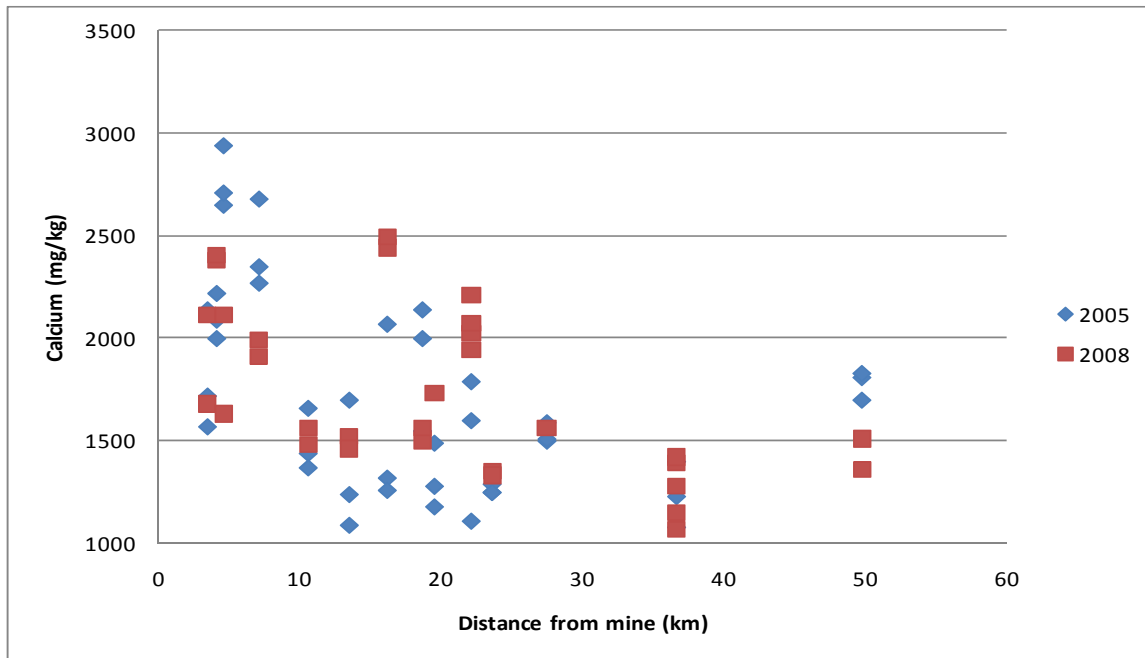


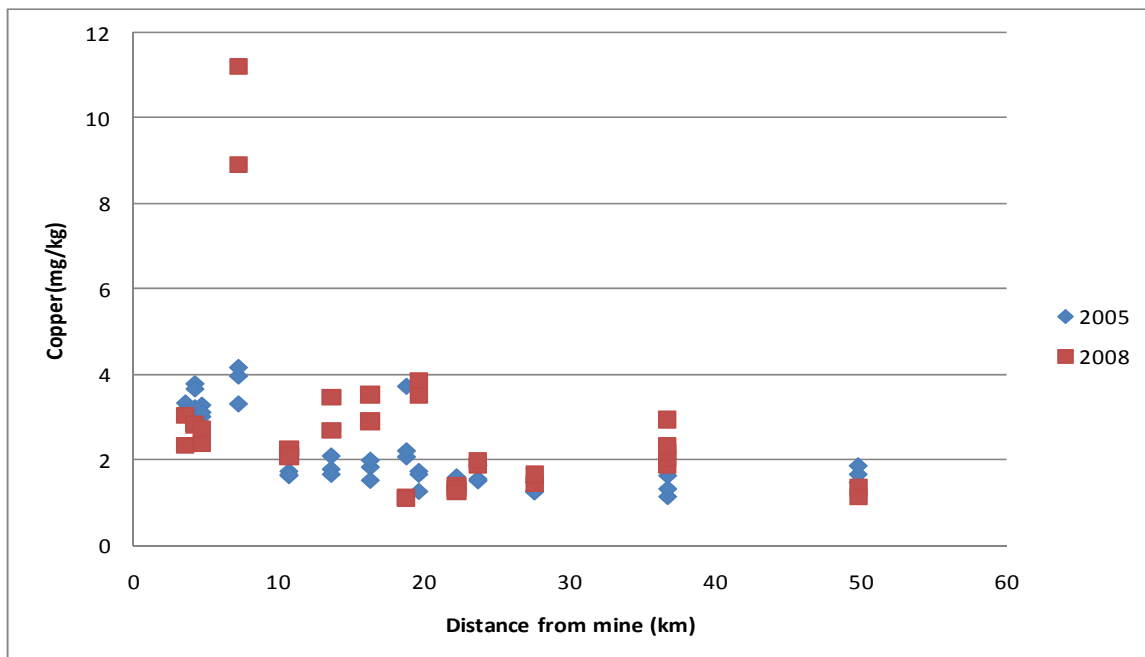
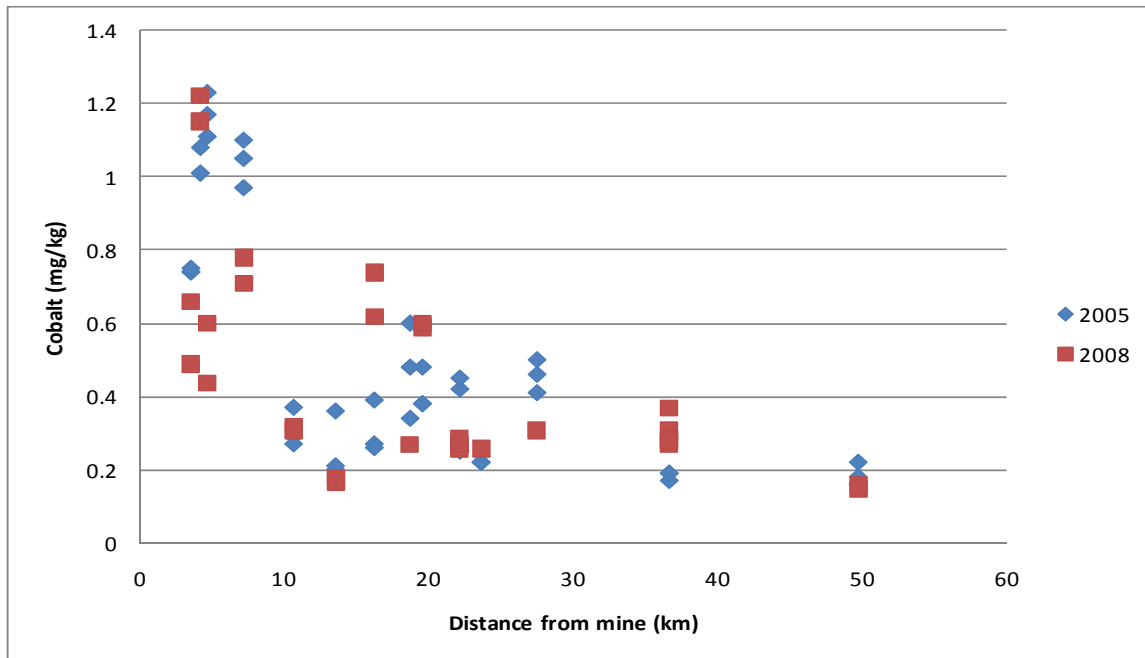


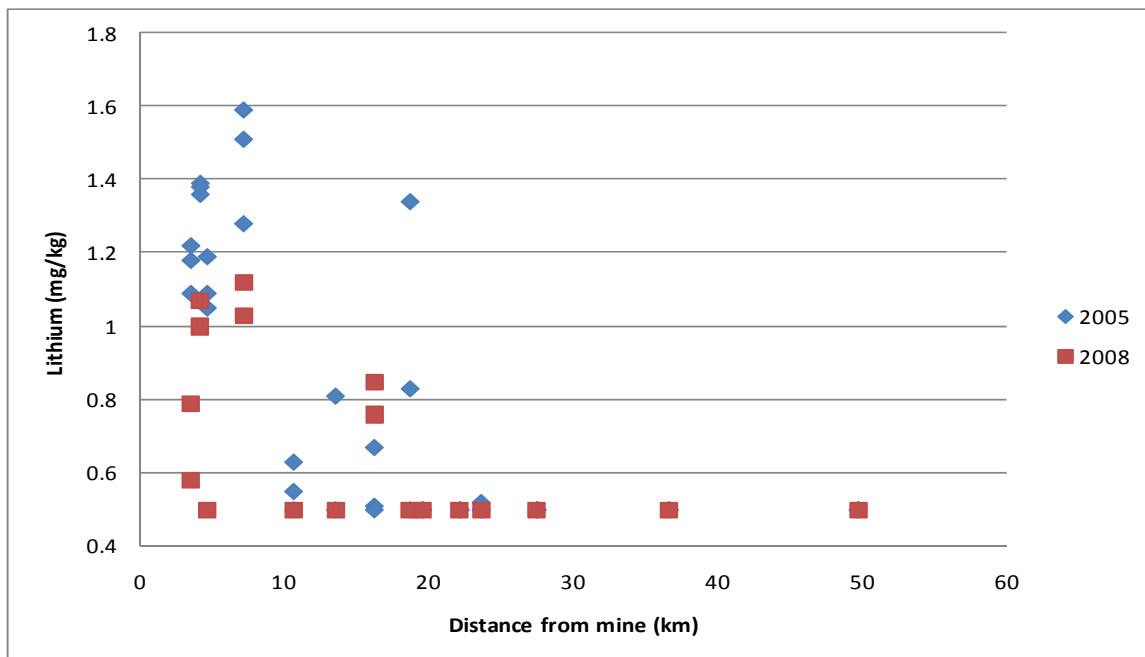
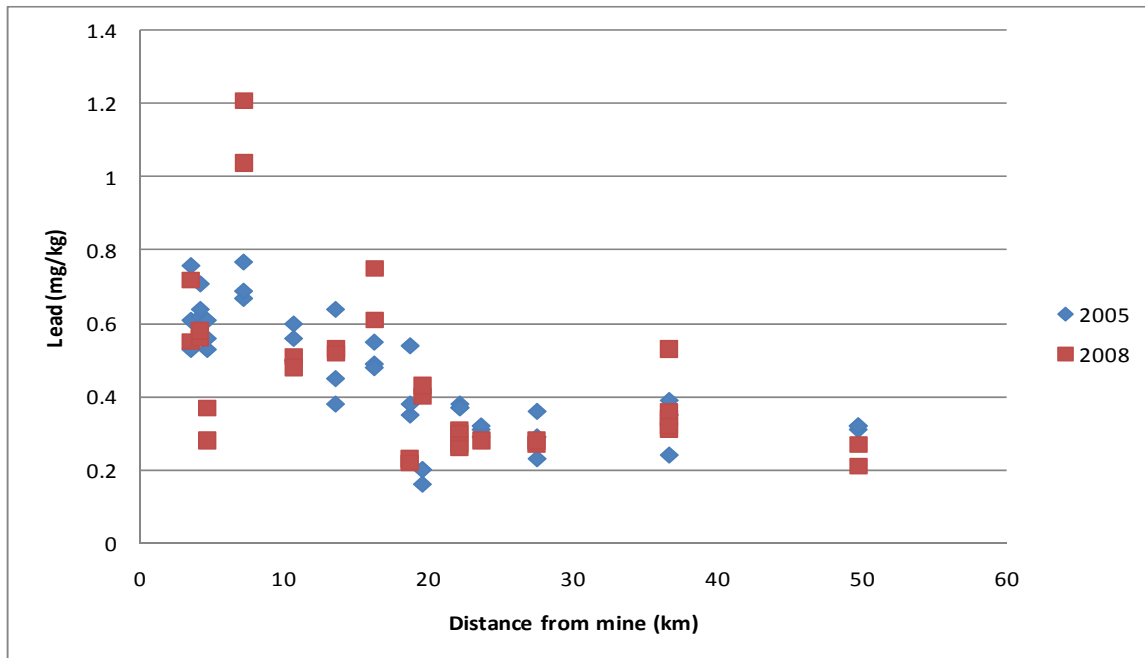


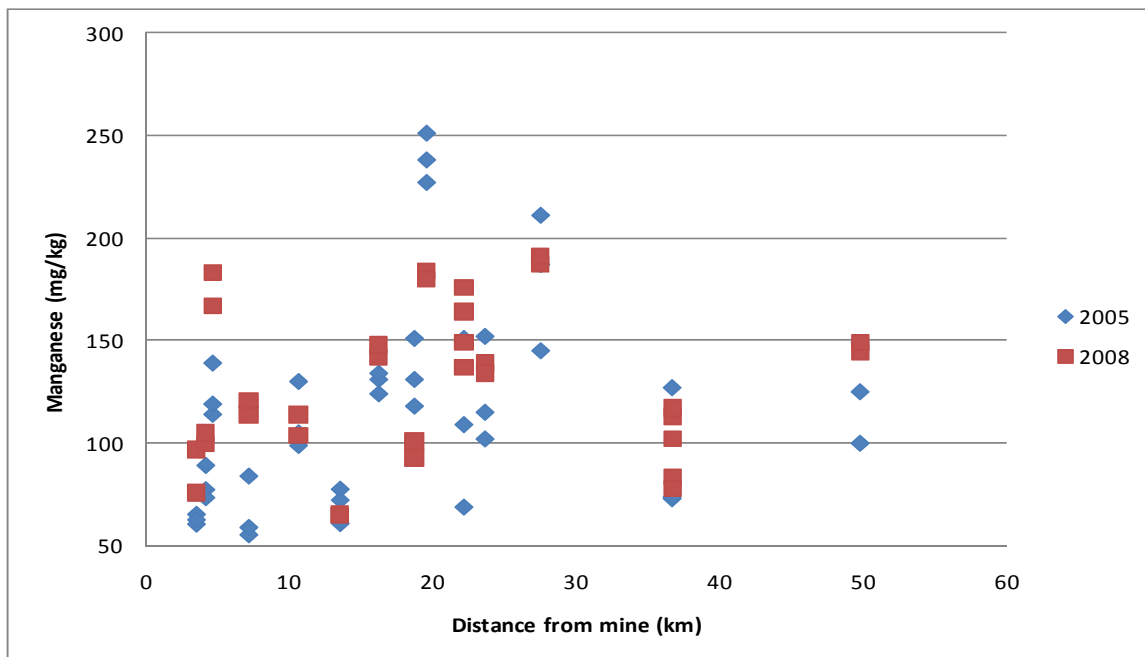
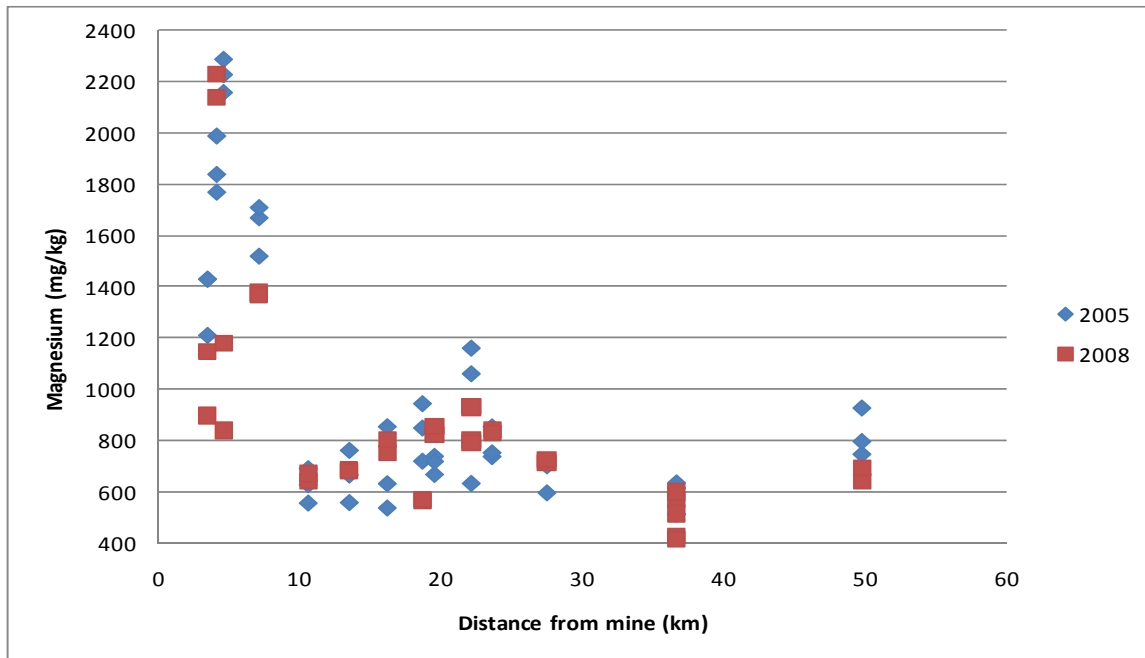


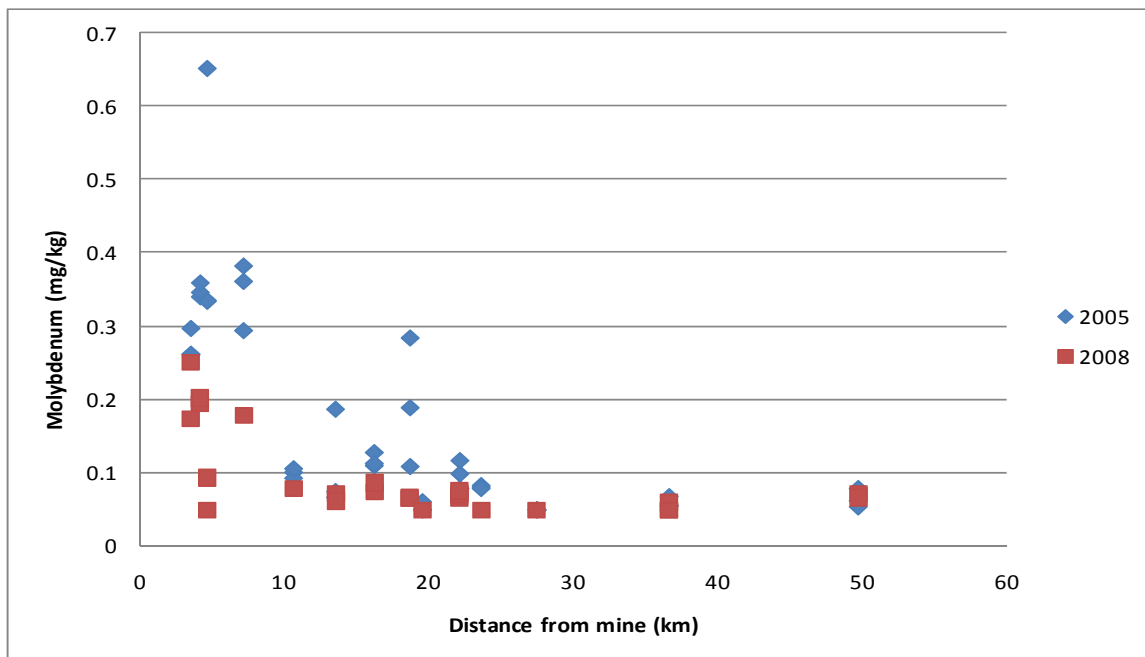
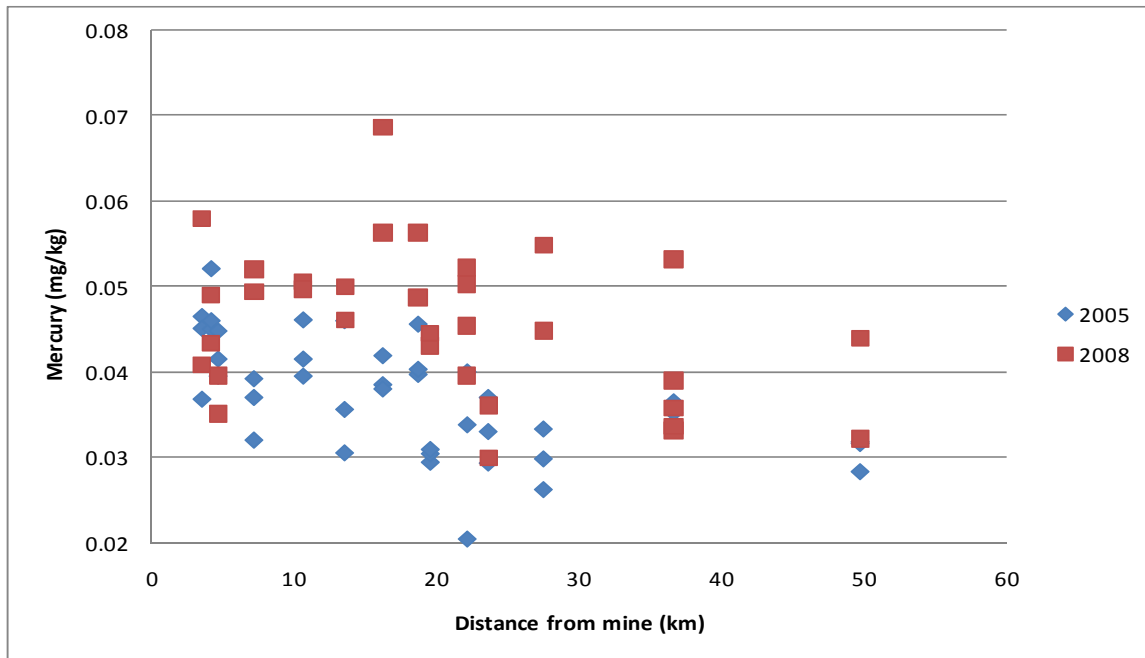


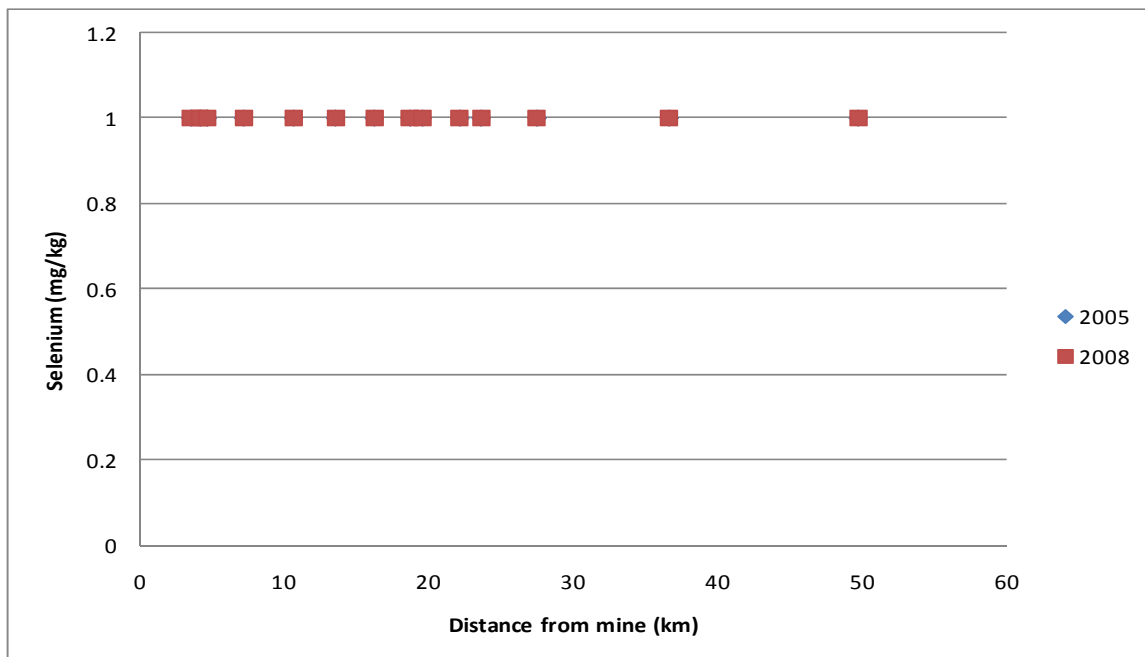
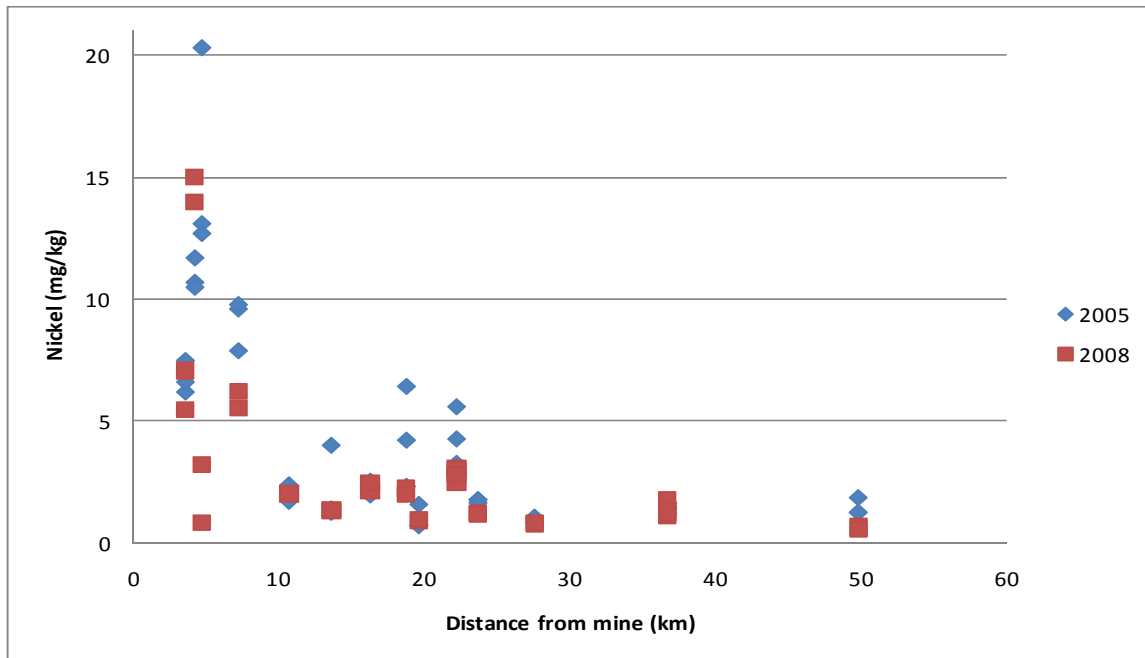


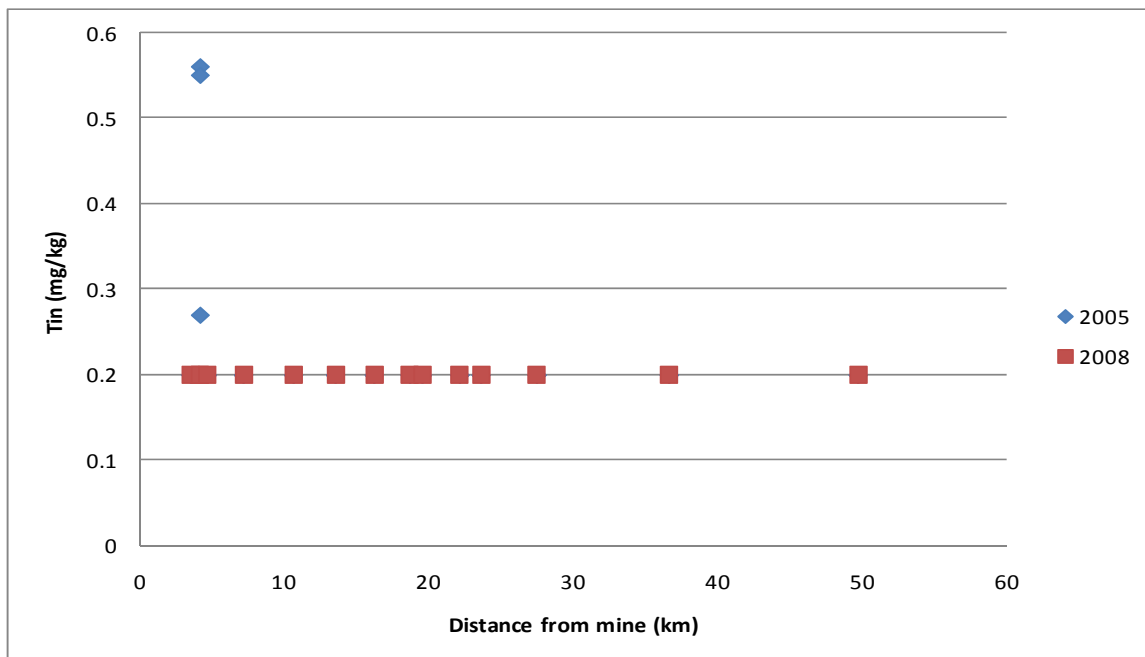
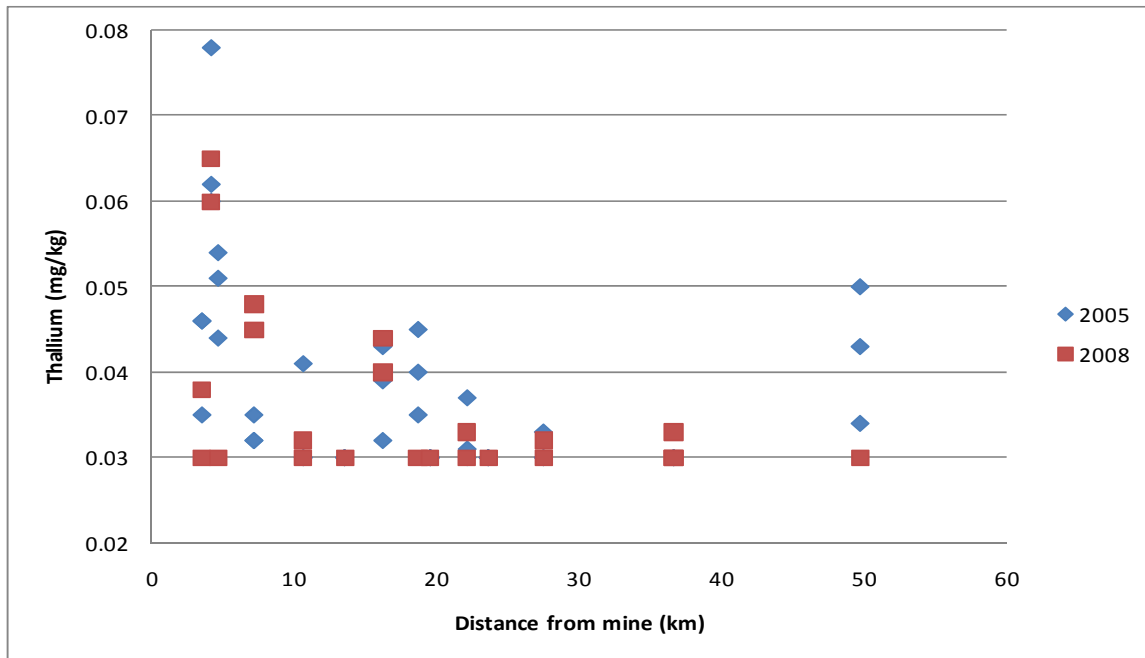


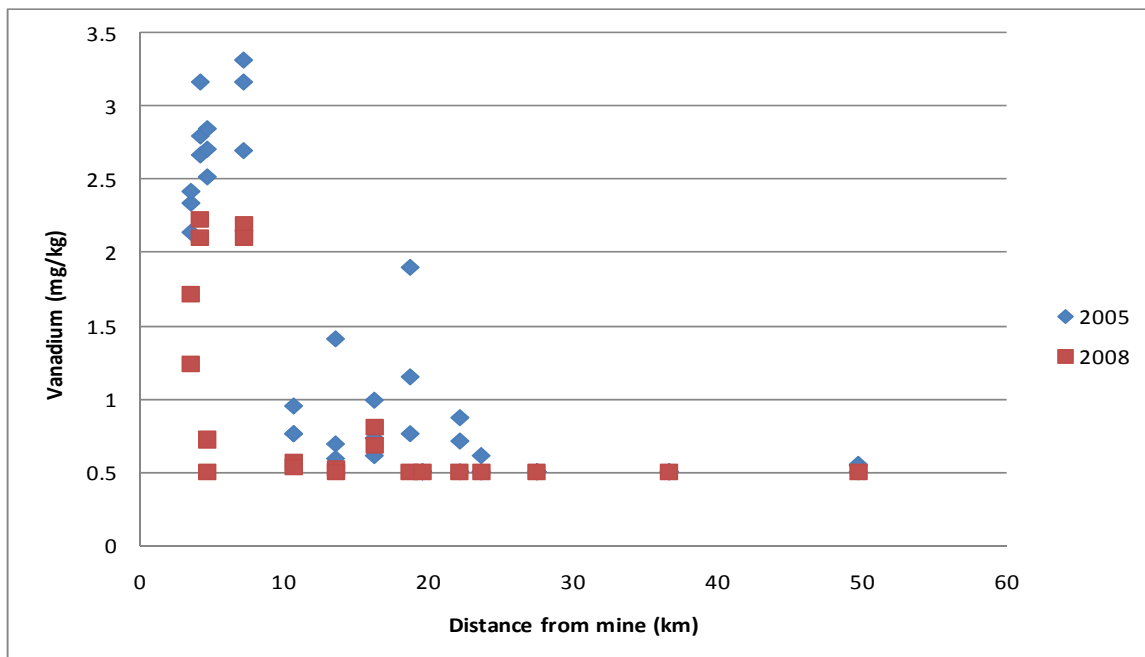
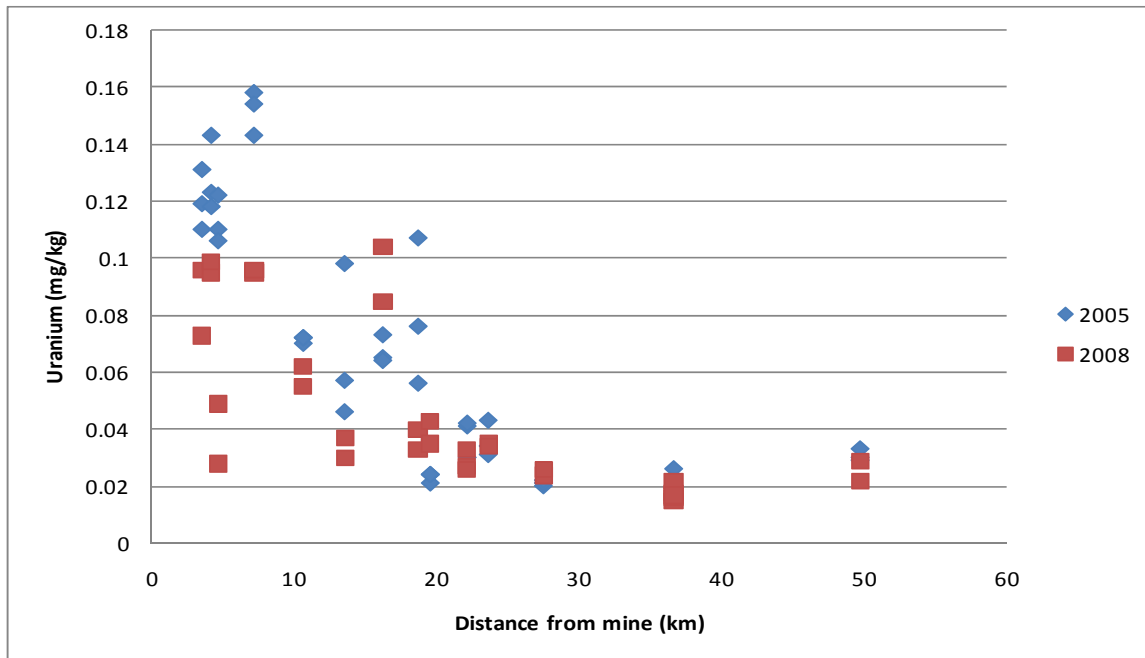


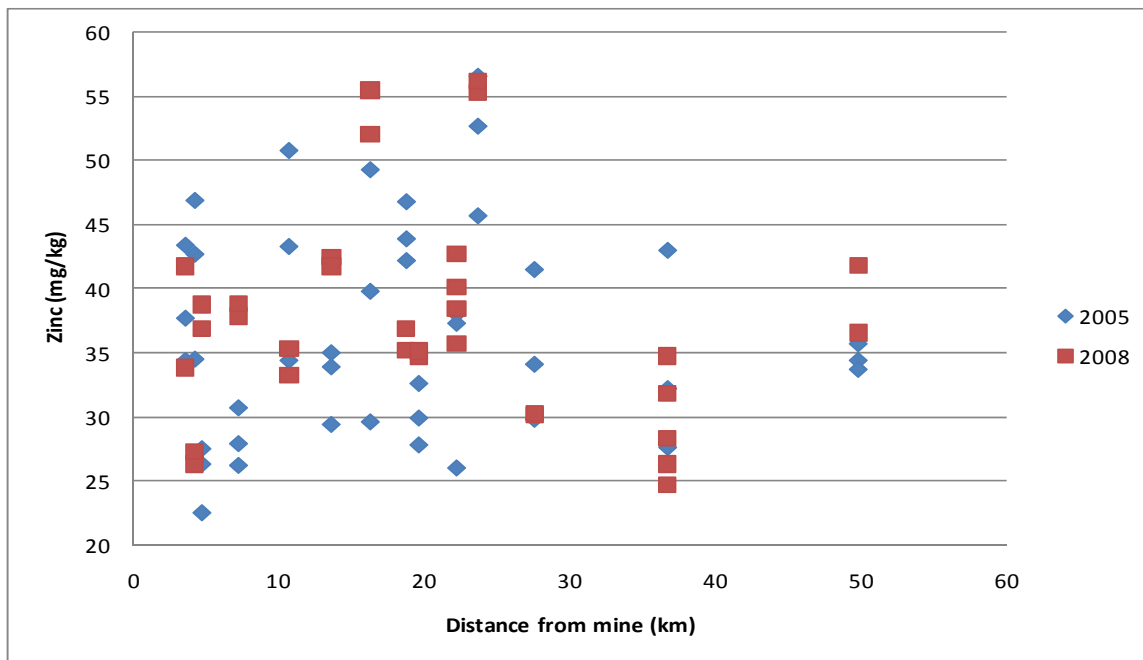












Appendix 2: Concentration of elements in *Flavocetraria cucullata* and *Peltigera (rufescens)* spp. Group from near EKATI Mine in 2008.

<i>Flavocetraria cucullata</i>			
Analyte	Mean	Min	Max
S	391.21	258.00	681.00
Al	330.58	53.00	1370.00
Sb	0.05	0.05	0.05
As	0.25	0.05	0.57
Ba	19.77	5.20	51.90
Be	0.30	0.30	0.30
Bi	0.30	0.30	0.30
Cd	0.05	0.03	0.10
Ca	1838.77	578.00	5120.00
Cr	3.44	0.50	12.80
Co	0.46	0.10	1.53
Cu	2.86	0.88	11.20
Pb	0.49	0.13	1.28
Li	0.64	0.50	2.07
Mg	890.14	191.00	2230.00
Mn	118.94	25.30	228.00
Hg	0.05	0.02	0.07
Mo	0.10	0.05	0.32
Ni	3.36	0.50	15.00
Se	1.00	1.00	1.00
Sr	7.66	1.84	21.50
S	368.84	295.00	643.00
Tl	0.04	0.03	0.07
Sn	0.20	0.20	0.20
U	0.05	0.01	0.22
V	0.91	0.50	3.94
Zn	35.79	11.10	56.20



<i>Peltigera rufescens</i>			
Analyte	Mean	Min	Max
S	795.00	253.00	1760.00
Al	775.00	171.00	3140.00
Sb	0.05	0.05	0.05
As	0.65	0.27	2.37
Ba	42.83	15.10	81.60
Be	0.30	0.30	0.30
Bi	0.30	0.30	0.30
Cd	0.10	0.03	0.41
Ca	2112.58	1350.00	4510.00
Cr	5.16	0.60	22.70
Co	1.60	0.39	4.18
Cu	8.61	4.83	18.50
Pb	0.65	0.20	1.24
Li	1.18	0.50	5.23
Mg	1745.77	642.00	5070.00
Mn	166.91	68.90	357.00
Hg	0.08	0.04	0.14
Mo	0.27	0.05	0.98
Ni	10.01	2.00	35.70
Se	1.00	1.00	1.00
Sr	15.87	5.04	49.30
S	1273.06	742.00	1850.00
Tl	0.05	0.03	0.11
Sn	0.20	0.20	0.20
U	0.19	0.03	0.95
V	2.29	0.50	9.42
Zn	51.40	32.60	70.30



Appendix 4

Dustfall Lab Analysis Data



CERTIFICATE OF ANALYSIS

Date: November 6, 2006

ALS File No. Z1762

Report On: 10648 Dustfall Analysis

Report To: **BHP Billiton Diamonds Inc.**
1102-4920, 52nd Street
Yellowknife, NT
X1A 3T1

Attention: **Ms. Karen Hosford**

Received: August 28, 2006

ALS ENVIRONMENTAL

per:

Can Dang, B.Sc. - Senior Account Manager
Andre Langlais, M.Sc. - Senior Account Manager

File No. Z1762

REMARKS



Please note that not all of the samples as noted on the chain of custody form were received at ALSE. The compliance team at Ekati was notified.

Due to lab errors the samples were prepared for the routine dustfall analyses. Hence, insufficient volume was available for the non-routine nutrients and anions analyses. Therefore, there is no data available for these parameters.

RESULTS OF ANALYSIS - Dustfall

Sample ID	FOX-D90-P	FOX-U30-M	SAB-U30-P	SAB-D300-M	SAB-D30-M
Sample Date	06-08-15	06-08-15	06-08-15	06-08-15	06-08-15
Sample Time	18:00	18:00	16:00	16:00	16:00
ALS ID	1	2	3	4	5

Field Tests

Interval ¹	30.0	30.0	30.0	30.0	30.0
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Dissolved Anions

Sulphate	SO4	no cut	-	no cut	-	-
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Nutrients

Nitrate Nitrogen	N	no cut	-	no cut	-	-
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Dustfall

Soluble Dustfall - Total	0.14	-	<0.10	-	-
Insoluble Dustfall - Total	3.61	-	<0.10	-	-
Total Dustfall	3.75	-	0.13	-	-

Remarks regarding the analyses appear at the beginning of this report.

Results are expressed as milligrams per square decimeter per day.

< = Less than the detection limit indicated.

¹Interval = number of days in the field.

RESULTS OF ANALYSIS - Dustfall

Sample ID		FOX-U30-M	SAB-D300-M	SAB-D30-M
Sample Date		06-08-15	06-08-15	06-08-15
Sample Time		18:00	16:00	16:00
ALS ID		2	4	5
<hr/>				
Total Metals				
Aluminum	T-Al	0.0930	0.00209	0.00130
Antimony	T-Sb	0.00000078	<0.00000052	<0.00000052
Arsenic	T-As	0.00000424	0.00000159	0.00000113
Barium	T-Ba	0.00170	0.0000624	0.0000521
Beryllium	T-Be	<0.0000026	<0.0000026	<0.0000026
Bismuth	T-Bi	<0.0000026	<0.0000026	<0.0000026
Boron	T-B	<0.000052	<0.000052	<0.000052
Cadmium	T-Cd	<0.00000026	<0.00000026	<0.00000026
Calcium	T-Ca	0.0568	0.00154	0.00123
Chromium	T-Cr	0.000359	0.0000186	0.0000073
Cobalt	T-Co	0.0000728	0.00000228	0.00000164
Copper	T-Cu	0.000188	0.0000924	0.000208
Iron	T-Fe	0.163	0.00303	0.00190
Lead	T-Pb	0.0000139	0.00000092	0.00000192
Lithium	T-Li	0.000165	<0.000026	<0.000026
Magnesium	T-Mg	0.149	0.00294	0.00173
Manganese	T-Mn	0.00139	0.0000548	0.0000408
Molybdenum	T-Mo	0.00000682	<0.00000026	<0.00000026
Nickel	T-Ni	0.000459	0.0000192	0.0000123
Phosphorus	T-P	0.0069	<0.0016	<0.0016
Potassium	T-K	0.092	<0.010	<0.010
Selenium	T-Se	<0.0000052	<0.0000052	<0.0000052
Silicon	T-Si	0.212	0.00333	0.00208
Silver	T-Ag	<0.000050	<0.000050	<0.000050
Sodium	T-Na	0.015	<0.010	<0.010
Strontium	T-Sr	0.000444	0.0000148	0.0000109
Thallium	T-Tl	0.00000188	<0.00000052	<0.00000052
Tin	T-Sn	0.00000347	<0.00000052	<0.00000052
Titanium	T-Ti	0.0119	0.000228	0.000148
Uranium	T-U	<0.000050	<0.000050	<0.000050
Vanadium	T-V	0.000282	0.0000097	0.0000067
Zinc	T-Zn	0.000346	0.0000218	0.0000208

Remarks regarding the analyses appear at the beginning of this report.
 Results are expressed as milligrams per square decimeter per day.
 < = Less than the detection limit indicated.



CERTIFICATE OF ANALYSIS

Date: November 7, 2006

ALS File No. Z2845

Report On: 10686 Water Analysis

Report To: **BHP Billiton Diamonds Inc.**
1102-4920, 52nd Street
Yellowknife, NT
X1A 3T1

Attention: **Ms. Karen Hosford**

Received: September 20, 2006

ALS ENVIRONMENTAL

per:

Can Dang, B.Sc. - Senior Account Manager
Andre Langlais, M.Sc. - Senior Account Manager

File No. Z2845

RESULTS OF ANALYSIS - Water



Sample ID	Mis-D90-P	AQ-49-P	Fox-D90-P	Fox-U30-M	Fox-U30-P
Sample Date	06-09-15	06-09-15	06-09-15	06-09-15	06-09-15
Sample Time	11:55	14:00	10:25	10:09	10:09
ALS ID	1	2	3	4	5
Field Tests					
Interval ¹	30.0	30.0	30.0	30.0	30.0
Dissolved Anions					
Sulphate SO4	0.75	<0.50	0.78	-	2.90
Nutrients					
Nitrate Nitrogen N	0.0883	0.0269	0.0505	-	0.0772
Dustfall					
Soluble Dustfall - Total	0.10	0.19	0.13	-	0.32
Insoluble Dustfall - Total	3.75	<0.10	1.85	-	10.6
Total Dustfall	3.86	0.25	1.98	-	10.9

Sulphate and Nitrate results are expressed as milligrams per litre.
 Results are expressed as milligrams per square decimeter per day.
 < = Less than the detection limit indicated.
¹Interval = number of days in the field.

File No. Z2845

RESULTS OF ANALYSIS - Water



Sample ID Fox-U30-M
Sample Date 06-09-15
Sample Time 10:09
ALS ID 4

Total Metals

Aluminum	T-Al	0.0511
Antimony	T-Sb	0.00000056
Arsenic	T-As	0.00000275
Barium	T-Ba	0.000948
Beryllium	T-Be	<0.0000026
Bismuth	T-Bi	<0.0000026
Boron	T-B	<0.000052
Cadmium	T-Cd	<0.00000026
Calcium	T-Ca	0.0150
Chromium	T-Cr	0.000202
Cobalt	T-Co	0.0000415
Copper	T-Cu	0.000100
Iron	T-Fe	0.0663
Lead	T-Pb	0.00000668
Lithium	T-Li	0.000091
Magnesium	T-Mg	0.0607
Manganese	T-Mn	0.000810
Molybdenum	T-Mo	0.00000525
Nickel	T-Ni	0.000240
Phosphorus	T-P	0.0016
Potassium	T-K	0.040
Selenium	T-Se	<0.0000052
Silicon	T-Si	0.108
Silver	T-Ag	<0.000010
Sodium	T-Na	<0.010
Strontium	T-Sr	0.000179
Thallium	T-Tl	0.00000109
Tin	T-Sn	0.00000160
Titanium	T-Ti	0.00513
Uranium	T-U	<0.000010
Vanadium	T-V	0.000159
Zinc	T-Zn	0.000338

Sulphate and Nitrate results are expressed as milligrams per litre.
Results are expressed as milligrams per square decimeter per day.
< = Less than the detection limit indicated.

File No. Z2845

RESULTS OF ANALYSIS - Water



Sample ID	Mis-D300 -M	Mis-D300 -P	Mis-D30 -M	AQ-49-M	Mis-D90 -M
Sample Date	06-09-15	06-09-15	06-09-15	06-09-15	06-09-15
Sample Time	11:49	11:49	12:00	14:00	11:55
ALS ID	6	7	8	9	10

Field Tests

Interval ¹	30.0	30.0	30.0	30.0	30.0
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Dissolved Anions

Sulphate	SO4	-	<0.50	-	-	-
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Nutrients

Nitrate Nitrogen	N	-	0.0541	-	-	-
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Dustfall

Soluble Dustfall - Total	-	<0.10	-	-	-
Insoluble Dustfall - Total	-	0.91	-	-	-
Total Dustfall	-	1.00	-	-	-

Sulphate and Nitrate results are expressed as milligrams per litre.
 Results are expressed as milligrams per square decimeter per day.
 < = Less than the detection limit indicated.
¹Interval = number of days in the field.

RESULTS OF ANALYSIS - Water

Sample ID		Mis-D300 -M	Mis-D30 -M	AQ-49-M	Mis-D90 -M
Sample Date		06-09-15	06-09-15	06-09-15	06-09-15
Sample Time		11:49	12:00	14:00	11:55
ALS ID		6	8	9	10
<hr/>					
Total Metals					
Aluminum	T-Al	0.00257	0.00722	0.000485	0.00557
Antimony	T-Sb	<0.00000052	<0.00000052	<0.00000037	<0.00000052
Arsenic	T-As	0.00000062	0.00000071	0.00000039	0.00000260
Barium	T-Ba	0.0000613	0.000192	0.00000683	0.000127
Beryllium	T-Be	<0.0000026	<0.0000026	<0.0000018	<0.0000026
Bismuth	T-Bi	<0.0000026	<0.0000026	<0.0000018	<0.0000026
Boron	T-B	<0.000052	<0.000052	<0.000037	<0.000052
Cadmium	T-Cd	<0.00000026	<0.00000026	0.00000020	<0.00000026
Calcium	T-Ca	0.00317	0.00537	0.00097	0.0319
Chromium	T-Cr	0.0000092	0.0000266	<0.0000018	0.0000222
Cobalt	T-Co	0.00000251	0.00000581	<0.00000037	0.00000511
Copper	T-Cu	0.000225	0.0000539	0.000614	0.000285
Iron	T-Fe	0.00453	0.0136	0.00022	0.119
Lead	T-Pb	0.00000183	0.00000202	0.00000605	0.00000552
Lithium	T-Li	<0.000026	<0.000026	<0.000018	<0.000026
Magnesium	T-Mg	0.00365	0.0106	<0.00037	0.0744
Manganese	T-Mn	0.0000863	0.000154	0.0000153	0.000136
Molybdenum	T-Mo	0.00000117	0.00000074	<0.00000018	<0.00000026
Nickel	T-Ni	0.0000126	0.0000283	0.0000021	0.0000219
Phosphorus	T-P	<0.0016	<0.0016	<0.0011	<0.016
Potassium	T-K	<0.010	0.011	<0.0073	<0.10
Selenium	T-Se	<0.0000052	<0.0000052	<0.0000037	<0.0000052
Silicon	T-Si	0.00763	0.0270	0.00044	0.208
Silver	T-Ag	<0.000010	<0.000010	<0.000010	<0.000010
Sodium	T-Na	<0.010	<0.010	<0.0073	<0.10
Strontium	T-Sr	0.0000134	0.0000390	0.00000312	0.0000137
Thallium	T-Tl	<0.00000052	<0.00000052	<0.00000037	<0.00000052
Tin	T-Sn	<0.00000052	<0.00000052	<0.00000037	<0.00000052
Titanium	T-Ti	0.000324	0.00103	<0.000037	0.00755
Uranium	T-U	<0.000010	<0.000010	<0.000010	<0.000010
Vanadium	T-V	0.0000094	0.0000252	<0.0000037	0.0000206
Zinc	T-Zn	0.000200	0.000224	0.000304	0.000159

Sulphate and Nitrate results are expressed as milligrams per litre.
 Results are expressed as milligrams per square decimeter per day.
 < = Less than the detection limit indicated.

File No. Z2845

RESULTS OF ANALYSIS - Water



Sample ID	Sab-U30 -M	Mis-U30 -M	Mis-U30 -P	Sab-D300 -M	Sab-D300 -P
Sample Date	06-09-15	06-09-15	06-09-15	06-09-15	06-09-15
Sample Time	09:36	11:40	11:40	09:15	09:15
ALS ID	11	12	13	14	15

Field Tests

Interval ¹	30.0	30.0	30.0	30.0	30.0
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Dissolved Anions

Sulphate	SO4	-	-	0.75	-	0.52
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Nutrients

Nitrate Nitrogen	N	-	-	0.0976	-	0.0489
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Dustfall

Soluble Dustfall - Total	-	-	0.13	-	<0.10
Insoluble Dustfall - Total	-	-	4.53	-	0.21
Total Dustfall	-	-	4.65	-	0.31

Sulphate and Nitrate results are expressed as milligrams per litre.
 Results are expressed as milligrams per square decimeter per day.
 < = Less than the detection limit indicated.
¹Interval = number of days in the field.

RESULTS OF ANALYSIS - Water

Sample ID		Sab-U30 -M	Mis-U30 -M	Sab-D300 -M
Sample Date		06-09-15	06-09-15	06-09-15
Sample Time		09:36	11:40	09:15
ALS ID		11	12	14
<hr/>				
Total Metals				
Aluminum	T-Al	0.00119	0.0168	0.000992
Antimony	T-Sb	<0.00000052	<0.00000052	<0.00000052
Arsenic	T-As	<0.00000052	0.00000115	<0.00000052
Barium	T-Ba	0.0000385	0.000399	0.0000157
Beryllium	T-Be	<0.0000026	<0.0000026	<0.0000026
Bismuth	T-Bi	<0.0000026	<0.0000026	<0.0000026
Boron	T-B	<0.000052	<0.000052	<0.000052
Cadmium	T-Cd	<0.00000026	<0.00000026	<0.00000026
Calcium	T-Ca	0.0170	0.00912	0.00178
Chromium	T-Cr	0.0000051	0.0000653	<0.0000026
Cobalt	T-Co	0.00000136	0.0000143	0.00000079
Copper	T-Cu	0.000423	0.000195	0.000199
Iron	T-Fe	0.0210	0.0313	0.00106
Lead	T-Pb	0.00000250	0.00000538	0.00000048
Lithium	T-Li	<0.000026	0.000065	<0.000026
Magnesium	T-Mg	0.0223	0.0235	0.00139
Manganese	T-Mn	0.0000415	0.000404	0.0000253
Molybdenum	T-Mo	0.00000027	0.00000224	<0.00000026
Nickel	T-Ni	0.0000103	0.0000784	0.0000056
Phosphorus	T-P	<0.016	<0.0016	<0.0016
Potassium	T-K	<0.10	0.020	<0.010
Selenium	T-Se	<0.0000052	<0.0000052	<0.0000052
Silicon	T-Si	0.0366	0.0521	0.00185
Silver	T-Ag	<0.000010	<0.000010	<0.000010
Sodium	T-Na	<0.10	<0.010	<0.010
Strontium	T-Sr	0.0000118	0.0000617	0.00000936
Thallium	T-Tl	<0.00000052	0.00000058	<0.00000052
Tin	T-Sn	0.00000055	0.00000107	<0.00000052
Titanium	T-Ti	0.00137	0.00227	0.000063
Uranium	T-U	<0.000010	<0.000010	<0.000010
Vanadium	T-V	<0.0000052	0.0000585	<0.0000052
Zinc	T-Zn	0.000215	0.000337	0.000175

Sulphate and Nitrate results are expressed as milligrams per litre.
 Results are expressed as milligrams per square decimeter per day.
 < = Less than the detection limit indicated.



Environmental Division

ANALYTICAL REPORT

BHP BILLITON DIAMONDS INC.

ATTN: KAREN HOSFORD

Reported On: 09-AUG-07 06:28 PM

1102-4920, 52ND STREET

YELLOWKNIFE NT X1A 3T1

Lab Work Order #: L526041

Date Received: 04-JUL-07

Project P.O. #: BHP2503

Job Reference: 10801

Legal Site Desc: 6200296543

CofC Numbers: 10801

Other Information:

Comments:

Timothy Guy Crowther
General Manager, Vancouver

For any questions about this report please contact your Account Manager:

Can Dang

THIS REPORT SHALL NOT BE REPRODUCED EXCEPT IN FULL WITHOUT THE WRITTEN AUTHORITY OF THE LABORATORY.
ALL SAMPLES WILL BE DISPOSED OF AFTER 30 DAYS FOLLOWING ANALYSIS. PLEASE CONTACT THE LAB IF YOU
REQUIRE ADDITIONAL SAMPLE STORAGE TIME.

ALS LABORATORY GROUP ANALYTICAL REPORT

Sample ID Description Sampled Date Sampled Time Client ID		L526041-1	L526041-2	L526041-3	L526041-4	L526041-5
Grouping Analyte						
DUSTFALL						
Particulates	Total Dustfall (mg/m2.day)		0.31		15.1	
	Total Insoluble Dustfall (mg/m2.day)		<0.10		14.8	
	Total Soluble Dustfall (mg/m2.day)		0.24		0.29	
Total Metals	Aluminum (Al)-Total (mg/dm2.day)	0.0119		0.105		0.00446
	Antimony (Sb)-Total (mg/dm2.day)	<0.0000010		<0.0000010		<0.0000010
	Arsenic (As)-Total (mg/dm2.day)	<0.0000010		0.0000047		<0.0000010
	Barium (Ba)-Total (mg/dm2.day)	0.000287		0.00184		0.0000993
	Beryllium (Be)-Total (mg/dm2.day)	<0.0000050		<0.0000050		<0.0000050
	Bismuth (Bi)-Total (mg/dm2.day)	<0.0000050		<0.0000050		<0.0000050
	Boron (B)-Total (mg/dm2.day)	<0.00010		<0.00010		<0.00010
	Cadmium (Cd)-Total (mg/dm2.day)	<0.00000050		<0.00000050		<0.00000050
	Calcium (Ca)-Total (mg/dm2.day)	0.00475		0.0275		0.00309
	Chromium (Cr)-Total (mg/dm2.day)	0.0000537		0.000325		0.0000158
	Cobalt (Co)-Total (mg/dm2.day)	0.0000107		0.0000667		0.0000039
	Copper (Cu)-Total (mg/dm2.day)	0.000158		0.000101		0.000471
	Lead (Pb)-Total (mg/dm2.day)	0.00000434		0.0000172		0.00000160
	Lithium (Li)-Total (mg/dm2.day)	<0.000050		0.000231		<0.000050
	Magnesium (Mg)-Total (mg/dm2.day)	0.0148		0.0861		0.00452
	Manganese (Mn)-Total (mg/dm2.day)	0.000241		0.00166		0.000123
	Mercury (Hg)-Total (mg/dm2.day)	0.0000405		0.0000741		0.0000265
	Molybdenum (Mo)-Total (mg/dm2.day)	0.00000066		0.00000246		<0.00000050
	Nickel (Ni)-Total (mg/dm2.day)	0.0000679		0.000315		0.0000263
	Potassium (K)-Total (mg/dm2.day)	0.0105		0.0748		0.00503
	Selenium (Se)-Total (mg/dm2.day)	<0.000010		<0.000010		<0.000010
	Silver (Ag)-Total (mg/dm2.day)	<0.00000010		0.00000024		<0.00000010
	Sodium (Na)-Total (mg/dm2.day)	0.00112		0.0149		0.00424
	Strontium (Sr)-Total (mg/dm2.day)	0.0000424		0.000361		0.0000226
	Thallium (Tl)-Total (mg/dm2.day)	<0.0000010		0.0000024		<0.0000010
	Tin (Sn)-Total (mg/dm2.day)	<0.0000010		0.0000039		0.0000019
	Uranium (U)-Total (mg/dm2.day)	0.00000075		0.00000703		0.00000061
	Vanadium (V)-Total (mg/dm2.day)	0.000045		0.000299		0.000016
	Zinc (Zn)-Total (mg/dm2.day)	0.000065		0.000378		0.000096

ALS LABORATORY GROUP ANALYTICAL REPORT

Sample ID Description Sampled Date Sampled Time Client ID		L526041-6	L526041-7	L526041-8	L526041-9	L526041-10
Grouping Analyte						
DUSTFALL						
Particulates	Total Dustfall (mg/m2.day)	1.41		42.1		5.37
	Total Insoluble Dustfall (mg/m2.day)	1.30		41.8		5.30
	Total Soluble Dustfall (mg/m2.day)	0.12		0.34		<0.10
Total Metals	Aluminum (Al)-Total (mg/dm2.day)		0.115		0.000440	
	Antimony (Sb)-Total (mg/dm2.day)		<0.0000010		<0.0000010	
	Arsenic (As)-Total (mg/dm2.day)		0.0000050		<0.0000010	
	Barium (Ba)-Total (mg/dm2.day)		0.00194		0.00000949	
	Beryllium (Be)-Total (mg/dm2.day)		<0.0000050		<0.0000050	
	Bismuth (Bi)-Total (mg/dm2.day)		<0.0000050		<0.0000050	
	Boron (B)-Total (mg/dm2.day)		<0.00010		<0.00010	
	Cadmium (Cd)-Total (mg/dm2.day)		<0.00000050		<0.00000050	
	Calcium (Ca)-Total (mg/dm2.day)		0.0341		0.00064	
	Chromium (Cr)-Total (mg/dm2.day)		0.000345		<0.0000050	
	Cobalt (Co)-Total (mg/dm2.day)		0.0000707		<0.0000010	
	Copper (Cu)-Total (mg/dm2.day)		0.000135		0.000149	
	Lead (Pb)-Total (mg/dm2.day)		0.0000219		<0.00000050	
	Lithium (Li)-Total (mg/dm2.day)		0.000248		<0.000050	
	Magnesium (Mg)-Total (mg/dm2.day)		0.0924		0.000472	
	Manganese (Mn)-Total (mg/dm2.day)		0.00177		0.0000187	
	Mercury (Hg)-Total (mg/dm2.day)		0.0000540		0.00000285	
	Molybdenum (Mo)-Total (mg/dm2.day)		0.00000324		<0.00000050	
	Nickel (Ni)-Total (mg/dm2.day)		0.000345		<0.0000050	
	Potassium (K)-Total (mg/dm2.day)		0.0798		0.00091	
	Selenium (Se)-Total (mg/dm2.day)		<0.000010		<0.000010	
	Silver (Ag)-Total (mg/dm2.day)		0.00000037		<0.00000010	
	Sodium (Na)-Total (mg/dm2.day)		0.0189		0.00105	
	Strontium (Sr)-Total (mg/dm2.day)		0.000475		0.0000033	
	Thallium (Tl)-Total (mg/dm2.day)		0.0000024		<0.0000010	
	Tin (Sn)-Total (mg/dm2.day)		0.0000043		<0.0000010	
	Uranium (U)-Total (mg/dm2.day)		0.00000984		<0.00000010	
	Vanadium (V)-Total (mg/dm2.day)		0.000306		<0.000010	
	Zinc (Zn)-Total (mg/dm2.day)		0.000394		0.000031	

ALS LABORATORY GROUP ANALYTICAL REPORT

Sample ID Description Sampled Date Sampled Time Client ID		L526041-11	L526041-12	L526041-13	L526041-14	L526041-15
Grouping Analyte						
DUSTFALL						
Particulates	Total Dustfall (mg/m2.day)		0.66	5.33		1.47
	Total Insoluble Dustfall (mg/m2.day)		0.61	5.33		1.40
	Total Soluble Dustfall (mg/m2.day)		<0.10	<0.10		<0.10
Total Metals	Aluminum (Al)-Total (mg/dm2.day)	0.0107			0.00520	
	Antimony (Sb)-Total (mg/dm2.day)	<0.0000010			<0.0000010	
	Arsenic (As)-Total (mg/dm2.day)	<0.0000010			<0.0000010	
	Barium (Ba)-Total (mg/dm2.day)	0.000277			0.000154	
	Beryllium (Be)-Total (mg/dm2.day)	<0.0000050			<0.0000050	
	Bismuth (Bi)-Total (mg/dm2.day)	<0.0000050			<0.0000050	
	Boron (B)-Total (mg/dm2.day)	<0.00010			<0.00010	
	Cadmium (Cd)-Total (mg/dm2.day)	0.00000161			<0.00000050	
	Calcium (Ca)-Total (mg/dm2.day)	0.00531			0.00676	
	Chromium (Cr)-Total (mg/dm2.day)	0.0000442			0.0000224	
	Cobalt (Co)-Total (mg/dm2.day)	0.0000095			0.0000061	
	Copper (Cu)-Total (mg/dm2.day)	0.0000792			0.000109	
	Lead (Pb)-Total (mg/dm2.day)	0.0000153			0.00000197	
	Lithium (Li)-Total (mg/dm2.day)	<0.000050			<0.000050	
	Magnesium (Mg)-Total (mg/dm2.day)	0.0120			0.0118	
	Manganese (Mn)-Total (mg/dm2.day)	0.000212			0.000291	
	Mercury (Hg)-Total (mg/dm2.day)	0.0000537			0.0000369	
	Molybdenum (Mo)-Total (mg/dm2.day)	<0.00000050			<0.00000050	
	Nickel (Ni)-Total (mg/dm2.day)	0.0000455			0.0000439	
	Potassium (K)-Total (mg/dm2.day)	0.0100			0.0472	
	Selenium (Se)-Total (mg/dm2.day)	<0.000010			<0.000010	
	Silver (Ag)-Total (mg/dm2.day)	<0.00000010			<0.00000010	
	Sodium (Na)-Total (mg/dm2.day)	0.00114			0.00397	
	Strontium (Sr)-Total (mg/dm2.day)	0.0000350			0.0000447	
	Thallium (Tl)-Total (mg/dm2.day)	<0.0000010			<0.0000010	
	Tin (Sn)-Total (mg/dm2.day)	<0.0000010			<0.0000010	
	Uranium (U)-Total (mg/dm2.day)	0.00000080			0.00000049	
	Vanadium (V)-Total (mg/dm2.day)	0.000038			0.000020	
	Zinc (Zn)-Total (mg/dm2.day)	0.000060			0.000148	

ALS LABORATORY GROUP ANALYTICAL REPORT

Sample ID Description Sampled Date Sampled Time Client ID		L526041-16	L526041-17	L526041-18	L526041-19	L526041-20
Grouping Analyte						
DUSTFALL						
Particulates	Total Dustfall (mg/m2.day)	9.60		19.6		
	Total Insoluble Dustfall (mg/m2.day)	9.43		19.6		
	Total Soluble Dustfall (mg/m2.day)	0.17		<0.10		
Total Metals	Aluminum (Al)-Total (mg/dm2.day)		0.105		0.0167	0.0663
	Antimony (Sb)-Total (mg/dm2.day)		<0.0000010		<0.0000010	<0.0000010
	Arsenic (As)-Total (mg/dm2.day)		0.0000049		0.0000015	0.0000025
	Barium (Ba)-Total (mg/dm2.day)		0.00185		0.000294	0.00111
	Beryllium (Be)-Total (mg/dm2.day)		<0.0000050		<0.0000050	<0.0000050
	Bismuth (Bi)-Total (mg/dm2.day)		<0.0000050		<0.0000050	<0.0000050
	Boron (B)-Total (mg/dm2.day)		<0.00010		<0.00010	<0.00010
	Cadmium (Cd)-Total (mg/dm2.day)		<0.00000050		<0.00000050	<0.00000050
	Calcium (Ca)-Total (mg/dm2.day)		0.0398		0.0127	0.0159
	Chromium (Cr)-Total (mg/dm2.day)		0.000376		0.0000592	0.000203
	Cobalt (Co)-Total (mg/dm2.day)		0.0000794		0.0000142	0.0000426
	Copper (Cu)-Total (mg/dm2.day)		0.000147		0.0000889	0.0000803
	Lead (Pb)-Total (mg/dm2.day)		0.0000174		0.00000320	0.0000118
	Lithium (Li)-Total (mg/dm2.day)		0.000194		<0.000050	0.000147
	Magnesium (Mg)-Total (mg/dm2.day)		0.113		0.0220	0.0536
	Manganese (Mn)-Total (mg/dm2.day)		0.00155		0.000503	0.00100
	Mercury (Hg)-Total (mg/dm2.day)		0.0000662		0.0000155	0.0000561
	Molybdenum (Mo)-Total (mg/dm2.day)		0.00000649		0.00000117	0.00000140
	Nickel (Ni)-Total (mg/dm2.day)		0.000476		0.0000758	0.000191
	Potassium (K)-Total (mg/dm2.day)		0.0720		0.0326	0.0455
	Selenium (Se)-Total (mg/dm2.day)		<0.000010		<0.000010	<0.000010
	Silver (Ag)-Total (mg/dm2.day)		0.00000022		<0.00000010	0.00000013
	Sodium (Na)-Total (mg/dm2.day)		0.0197		0.00315	0.00982
	Strontium (Sr)-Total (mg/dm2.day)		0.000515		0.0000935	0.000225
	Thallium (Tl)-Total (mg/dm2.day)		0.0000018		<0.0000010	0.0000014
	Tin (Sn)-Total (mg/dm2.day)		0.0000026		<0.0000010	0.0000030
	Uranium (U)-Total (mg/dm2.day)		0.00000486		0.00000096	0.00000408
	Vanadium (V)-Total (mg/dm2.day)		0.000309		0.000050	0.000184
	Zinc (Zn)-Total (mg/dm2.day)		0.000335		0.000113	0.000258

ALS LABORATORY GROUP ANALYTICAL REPORT

		Sample ID	L526041-21	L526041-22	L526041-23	L526041-24	L526041-25
		Description					
		Sampled Date	01-JUL-07	01-JUL-07	01-JUL-07	01-JUL-07	01-JUL-07
		Sampled Time	14:00	14:45	14:45	14:45	14:45
		Client ID	SAB-U30-P	FOX-D90-M	FOX-D30-P	FOX-D30-M	FOX-D300-P
Grouping	Analyte						
DUSTFALL							
Particulates	Total Dustfall (mg/m2.day)	1.77			5.36		35.2
	Total Insoluble Dustfall (mg/m2.day)	1.70			5.28		34.9
	Total Soluble Dustfall (mg/m2.day)	<0.10			<0.10		0.23
Total Metals	Aluminum (Al)-Total (mg/dm2.day)			0.119		0.0624	
	Antimony (Sb)-Total (mg/dm2.day)			<0.0000010		<0.0000010	
	Arsenic (As)-Total (mg/dm2.day)			0.0000053		0.0000027	
	Barium (Ba)-Total (mg/dm2.day)			0.00207		0.00113	
	Beryllium (Be)-Total (mg/dm2.day)			<0.0000050		<0.0000050	
	Bismuth (Bi)-Total (mg/dm2.day)			<0.0000050		<0.0000050	
	Boron (B)-Total (mg/dm2.day)			<0.00010		<0.00010	
	Cadmium (Cd)-Total (mg/dm2.day)			<0.00000050		<0.00000050	
	Calcium (Ca)-Total (mg/dm2.day)			0.0389		0.0216	
	Chromium (Cr)-Total (mg/dm2.day)			0.000428		0.000226	
	Cobalt (Co)-Total (mg/dm2.day)			0.0000887		0.0000472	
	Copper (Cu)-Total (mg/dm2.day)			0.000202		0.000149	
	Lead (Pb)-Total (mg/dm2.day)			0.0000170		0.00000866	
	Lithium (Li)-Total (mg/dm2.day)			0.000219		0.000118	
	Magnesium (Mg)-Total (mg/dm2.day)			0.128		0.0675	
	Manganese (Mn)-Total (mg/dm2.day)			0.00175		0.000927	
	Mercury (Hg)-Total (mg/dm2.day)			0.0000943		0.0000580	
	Molybdenum (Mo)-Total (mg/dm2.day)			0.0000148		0.00000340	
	Nickel (Ni)-Total (mg/dm2.day)			0.000509		0.000271	
	Potassium (K)-Total (mg/dm2.day)			0.0772		0.0418	
	Selenium (Se)-Total (mg/dm2.day)			<0.000010		<0.000010	
	Silver (Ag)-Total (mg/dm2.day)			0.00000017		0.00000016	
	Sodium (Na)-Total (mg/dm2.day)			0.0179		0.00880	
	Strontium (Sr)-Total (mg/dm2.day)			0.000493		0.000285	
	Thallium (Tl)-Total (mg/dm2.day)			0.0000021		0.0000012	
	Tin (Sn)-Total (mg/dm2.day)			0.0000029		0.0000032	
	Uranium (U)-Total (mg/dm2.day)			0.00000512		0.00000324	
	Vanadium (V)-Total (mg/dm2.day)			0.000348		0.000185	
	Zinc (Zn)-Total (mg/dm2.day)			0.000372		0.000217	

ALS LABORATORY GROUP ANALYTICAL REPORT

		Sample ID			
		Description			
		Sampled Date			
		Sampled Time			
		Client ID			
Grouping	Analyte				
DUSTFALL					
Particulates	Total Dustfall (mg/m2.day)		<0.10		
	Total Insoluble Dustfall (mg/m2.day)		<0.10		
	Total Soluble Dustfall (mg/m2.day)		<0.10		
Total Metals	Aluminum (Al)-Total (mg/dm2.day)	0.298		0.000369	
	Antimony (Sb)-Total (mg/dm2.day)	<0.0000010		<0.0000010	
	Arsenic (As)-Total (mg/dm2.day)	0.0000147		<0.0000010	
	Barium (Ba)-Total (mg/dm2.day)	0.00561		0.00000861	
	Beryllium (Be)-Total (mg/dm2.day)	<0.0000050		<0.0000050	
	Bismuth (Bi)-Total (mg/dm2.day)	<0.0000050		<0.0000050	
	Boron (B)-Total (mg/dm2.day)	<0.00010		<0.00010	
	Cadmium (Cd)-Total (mg/dm2.day)	0.00000074		<0.00000050	
	Calcium (Ca)-Total (mg/dm2.day)	0.110		0.00062	
	Chromium (Cr)-Total (mg/dm2.day)	0.00109		<0.0000050	
	Cobalt (Co)-Total (mg/dm2.day)	0.000232		<0.0000010	
	Copper (Cu)-Total (mg/dm2.day)	0.000357		0.000196	
	Lead (Pb)-Total (mg/dm2.day)	0.0000412		0.00000096	
	Lithium (Li)-Total (mg/dm2.day)	0.000576		<0.000050	
	Magnesium (Mg)-Total (mg/dm2.day)	0.337		0.000464	
	Manganese (Mn)-Total (mg/dm2.day)	0.00475		0.0000183	
	Mercury (Hg)-Total (mg/dm2.day)	0.000101		0.00000402	
	Molybdenum (Mo)-Total (mg/dm2.day)	0.0000192		<0.00000050	
	Nickel (Ni)-Total (mg/dm2.day)	0.00133		<0.0000050	
	Potassium (K)-Total (mg/dm2.day)	0.215		0.00069	
	Selenium (Se)-Total (mg/dm2.day)	<0.000010		<0.000010	
	Silver (Ag)-Total (mg/dm2.day)	0.00000050		<0.00000010	
	Sodium (Na)-Total (mg/dm2.day)	0.0478		<0.00050	
	Strontium (Sr)-Total (mg/dm2.day)	0.00135		0.0000031	
	Thallium (Tl)-Total (mg/dm2.day)	0.0000057		<0.0000010	
	Tin (Sn)-Total (mg/dm2.day)	0.0000079		<0.0000010	
	Uranium (U)-Total (mg/dm2.day)	0.0000157		<0.00000010	
	Vanadium (V)-Total (mg/dm2.day)	0.000915		<0.000010	
	Zinc (Zn)-Total (mg/dm2.day)	0.000964		0.000024	

ALS LABORATORY GROUP ANALYTICAL REPORT

	<div>Sample ID Description Sampled Date Sampled Time Client ID</div>	L526041-2 01-JUL-07 16:00 AQ-49-P	L526041-4 01-JUL-07 10:15 MIS-U30-P	L526041-6 01-JUL-07 10:15 MIS-300-P	L526041-8 01-JUL-07 10:15 MIS-D30-P	L526041-10 01-JUL-07 10:15 MIS-D90-P
Grouping	Analyte					
WATER						
Anions and Nutrients	Sulfate (SO4) (mg/L)	<0.50	2.46	0.71	4.45	1.53
	Nitrate (as N) (mg/L)	0.0449	0.354	0.126	0.730	0.269

ALS LABORATORY GROUP ANALYTICAL REPORT

		Sample ID	L526041-12	L526041-13	L526041-15	L526041-16	L526041-18
		Description					
		Sampled Date	01-JUL-07	01-JUL-07	01-JUL-07	01-JUL-07	01-JUL-07
		Sampled Time	14:00	14:00	14:00	14:45	14:45
		Client ID	SAB-D300-P	SAB-D30-P	SAB-D90-P	FOX-D90-P	FOX-U30-P
Grouping	Analyte						
WATER							
Anions and Nutrients	Sulfate (SO4) (mg/L)		0.91	1.66	0.66	3.67	4.67
	Nitrate (as N) (mg/L)		0.101	0.172	0.125	0.286	0.295

ALS LABORATORY GROUP ANALYTICAL REPORT

		Sample ID	L526041-21	L526041-23	L526041-25	L526041-27	
		Description					
		Sampled Date	01-JUL-07	01-JUL-07	01-JUL-07	01-JUL-07	
		Sampled Time	14:00	14:45	14:45	16:10	
		Client ID	SAB-U30-P	FOX-D30-P	FOX-D300-P	AQ-54-P	
Grouping	Analyte						
WATER							
Anions and Nutrients	Sulfate (SO4) (mg/L)	0.62	2.19	8.16	<0.50		
	Nitrate (as N) (mg/L)	0.119	0.207	0.372	0.0398		

Reference Information

Methods Listed (if applicable):

ALS Test Code	Matrix	Test Description	Analytical Method Reference(Based On)
ANIONS-NO3-IC-VA	Water	Nitrate by Ion Chromatography	APHA 4110 "Determination of Anions by IC
This analysis is carried out using procedures adapted from APHA Method 4110 "Determination of Anions by Ion Chromatography" and EPA Method 300.0 "Determination of Inorganic Anions by Ion Chromatography". Anions routinely determined by this method include: bromide, chloride, fluoride, nitrate, nitrite and sulphate.			
ANIONS-SO4-IC-VA	Water	Sulfate by Ion Chromatography	APHA 4110 "Determination of Anions by IC
This analysis is carried out using procedures adapted from APHA Method 4110 "Determination of Anions by Ion Chromatography" and EPA Method 300.0 "Determination of Inorganic Anions by Ion Chromatography". Anions routinely determined by this method include: bromide, chloride, fluoride, nitrate, nitrite and sulphate.			
DUSTFALLS-COM-DM2-VA	Dustfall	Combined dustfalls-Total, soluble, insol	BCMOE "DUSTFALLS"
Dustfall analysis is carried out in accordance with procedures published by the B.C. Ministry of Environment Laboratory.			
HG-DUST(DM2-CVAFS-VA)	Dustfall	Total Mercury in Dustfalls by CVAFS	EPA 245.7
This analysis is carried out using procedures adapted from "Standard Methods for the Examination of Water and Wastewater" published by the American Public Health Association, and with procedures adapted from "Test Methods for Evaluating Solid Waste" SW-846 published by the United States Environmental Protection Agency (EPA). Instrumental analysis is by cold vapour atomic fluorescence spectrophotometry (EPA Method 245.7).			
MET-DUST(DM2)-MS-VA	Dustfall	Total Metals in Dustfalls by ICPMS	EPA 6020A
This analysis is carried out using procedures adapted from "Standard Methods for the Examination of Water and Wastewater" published by the American Public Health Association, and with procedures adapted from "Test Methods for Evaluating Solid Waste" SW-846 published by the United States Environmental Protection Agency (EPA). Instrumental analysis is by inductively coupled plasma - mass spectrometry (EPA Method 6020A).			
** Laboratory Methods employed follow in-house procedures, which are generally based on nationally or internationally accepted methodologies. The last two letters of the above ALS Test Code column indicate the laboratory that performed analytical analysis for that test. Refer to the list below:			
Laboratory Definition Code	Laboratory Location	Laboratory Definition Code	Laboratory Location
VA	ALS LABORATORY GROUP - VANCOUVER, BC, CANADA		

GLOSSARY OF REPORT TERMS

Surr - A surrogate is an organic compound that is similar to the target analyte(s) in chemical composition and behavior but not normally detected in environmental samples. Prior to sample processing, samples are fortified with one or more surrogate compounds.

The reported surrogate recovery value provides a measure of method efficiency.

mg/kg (units) - unit of concentration based on mass, parts per million

mg/L (units) - unit of concentration based on volume, parts per million

N/A - Result not available. Refer to qualifier code and definition for explanation

Test results reported relate only to the samples as received by the laboratory.

UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.

Although test results are generated under strict QA/QC protocols, any unsigned test reports, faxes, or emails are considered preliminary.

ALS Laboratory Group has an extensive QA/QC program where all analytical data reported is analyzed using approved referenced procedures followed by checks and reviews by senior managers and quality assurance personnel. However, since the results are obtained from chemical measurements and thus cannot be guaranteed, ALS Laboratory Group assumes no liability for the use or interpretation of the results.



1988 Triumph Street, Vancouver, BC V5L 1K5
Tel: 604-253-4188 Toll Free: 1-800-665-0243 Fax: 604-253-6700
ALS Contact: Can Dang

CHAIN OF CUSTODY FORM

Form 10801

BHP Billiton Diamonds Inc.
1102 4920 52nd Street, Yellowknife, NT X1A 3T1
Tel: 867-880-2157 Fax: 867-880-4012
BHP Contacts: Karen Hosford/Rob MacLean

bhpbilliton

Station ID	Matrix	Date	Time	Init	Dustfall Metals	Insoluble Particulate	Nitrate	Soluble Particulate	Sulphate	Total Particulate
Sab-D300-M	Dust	7/1/2007	2:00:00 PM	SH	1	1	1	1	1	BHP2
AQ-49-P	Dust	7/1/2007	4:00:00 PM	SH	1	1	1	1	1	BHP2
Mis-U30-M	Dust	7/1/2007	10:15:00 A	SH	1	1	1	1	1	BHP2
Mis-U30-P	Dust	7/1/2007	10:15:00 A	SH	1	1	1	1	1	BHP2
Mis-D300-M	Dust	7/1/2007	10:15:00 A	SH	1	1	1	1	1	BHP2
Mis-D300-P	Dust	7/1/2007	10:15:00 A	SH	1	1	1	1	1	BHP2
Mis-D30-M	Dust	7/1/2007	10:15:00 A	SH	1	1	1	1	1	BHP2
AQ-49-M	Dust	7/1/2007	4:00:00 PM	SH	1	1	1	1	1	BHP2
Mis-D90-P	Dust	7/1/2007	10:15:00 A	SH	1	1	1	1	1	BHP2
Sab-U30-M	Dust	7/1/2007	2:00:00 PM	SH	1	1	1	1	1	BHP2
Sab-D300-P	Dust	7/1/2007	2:00:00 PM	SH	1	1	1	1	1	BHP2
Sab-D30-P	Dust	7/1/2007	2:00:00 PM	SH	1	1	1	1	1	BHP2
Sab-D90-M	Dust	7/1/2007	2:00:00 PM	SH	1	1	1	1	1	BHP2
Sab-D90-P	Dust	7/1/2007	2:45:00 PM	SH	1	1	1	1	1	BHP2
Fox-U30-M	Dust	7/1/2007	2:45:00 PM	SH	1	1	1	1	1	BHP2
Fox-U30-P	Dust	7/1/2007	2:45:00 PM	SH	1	1	1	1	1	BHP2
Sab-D30-M	Dust	7/1/2007	2:00:00 PM	SH	1	1	1	1	1	BHP2
Mis-D90-M	Dust	7/1/2007	10:15:00 A	SH	1	1	1	1	1	BHP2

Turn around Required: _____
Special Instructions (Billing details, QC reporting, etc): _____
Billing Code: BHP2503

compliance.team@bhpbilliton.com

Send Analytical Results to:

Cooler seal intact upon receipt? ☒ Yes ☐ No ☐ N/A
Sample temperature upon receipt: 21 c.
Frozen? ☐ Yes ☒ No

FOR LAB USE ONLY

Relinquished by:	Date	Time	Received by:	Date	Time
Relinquished by:	Date	Time	Received by:	Date	Time

ALS Environmental

excellence in analytical testing



1988 Triumph Street, Vancouver, BC V5L 1K5

Tel: 604-253-4188 Toll Free: 1-800-665-0243 Fax: 604-253-6700

ALS Contact: Can Dang

Form 10801

BHP Billiton Diamonds Inc.

1102 4920 52nd Street, Yellowknife, NT X1A 3T1

Tel: 867-880-2157 Fax: 867-880-4012

BHP Contacts: Karen Hosford/Rob MacLean



CHAIN OF CUSTODY FORM

For Lab Use

2526041

Station ID	Matrix	Date	Time	Init	Dustfall Metals	Insoluble Particulate	Nitrate	Soluble Particulate	Sulphate	Total Particulate										
Sab-U30-P	Dust	7/1/2007	2:00:00 PM	SH	1	1	1	1	1	BHP2										
Fox-D90-M	Dust	7/1/2007	2:45:00 PM	SH	1	1	1	1	1	BHP2										
Fox-D30-P	Dust	7/1/2007	2:45:00 PM	SH	1	1	1	1	1	BHP2										
Fox-D30-M	Dust	7/1/2007	2:45:00 PM	SH	1	1	1	1	1	BHP2										
Fox-D300-P	Dust	7/1/2007	2:45:00 PM	SH	1	1	1	1	1	BHP2										
Fox-D300-M	Dust	7/1/2007	2:45:00 PM	SH	1	1	1	1	1	BHP2										
AQ-54-P	Dust	7/1/2007	4:10:00 PM	SH	1	1	1	1	1	BHP2										
AQ-54-M	Dust	7/1/2007	4:10:00 PM	SH	1	1	1	1	1	BHP2										

Turn around Required: _____

Special Instructions (Billing details, QC reporting, etc): _____

Billing Code: BHP2503

Relinquished by:	Date	Received by:	Date
	Time		Time
Relinquished by:	Date	Received by:	Date
	Time		Time

FOR LAB USE ONLY

Cooler seal intact upon receipt?	Sample temperature upon receipt:
<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	Frozen? <input type="checkbox"/> Yes <input type="checkbox"/> No C.

compliance.team@bhpbilliton.com

Send Analytical Results to:



Environmental Division

ANALYTICAL REPORT

BHP BILLITON DIAMONDS INC.

ATTN: KAREN HOSFORD

Reported On: 23-AUG-07 01:30 PM

1102-4920, 52ND STREET

YELLOWKNIFE NT X1A 3T1

Lab Work Order #: L538683

Date Received: 07-AUG-07

Project P.O. #: BHP2503

Job Reference: 10842

Legal Site Desc: 6200296543

CofC Numbers: 10842

Other Information:

Comments:

Timothy Guy Crowther
General Manager, Vancouver

For any questions about this report please contact your Account Manager:

Can Dang

THIS REPORT SHALL NOT BE REPRODUCED EXCEPT IN FULL WITHOUT THE WRITTEN AUTHORITY OF THE LABORATORY.
ALL SAMPLES WILL BE DISPOSED OF AFTER 30 DAYS FOLLOWING ANALYSIS. PLEASE CONTACT THE LAB IF YOU
REQUIRE ADDITIONAL SAMPLE STORAGE TIME.

ALS LABORATORY GROUP ANALYTICAL REPORT

		Sample ID				
		Description				
		Sampled Date				
		Sampled Time				
		Client ID				
Grouping	Analyte					
DUSTFALL						
Particulates	Total Dustfall (mg/m2.day)		1.57		25.1	
	Total Insoluble Dustfall (mg/m2.day)		0.90		24.0	
	Total Soluble Dustfall (mg/m2.day)		0.67		1.05	
Total Metals	Aluminum (Al)-Total (mg/dm2.day)	0.00733		0.0372		0.0168
	Antimony (Sb)-Total (mg/dm2.day)	<0.00000050		<0.0000030		<0.00000050
	Arsenic (As)-Total (mg/dm2.day)	0.00000117		<0.0000030		0.00000106
	Barium (Ba)-Total (mg/dm2.day)	0.000193		0.000679		0.000265
	Beryllium (Be)-Total (mg/dm2.day)	<0.0000030		<0.000010		<0.0000030
	Bismuth (Bi)-Total (mg/dm2.day)	<0.0000030		<0.000010		<0.0000030
	Boron (B)-Total (mg/dm2.day)	<0.000050		<0.00030		<0.000050
	Cadmium (Cd)-Total (mg/dm2.day)	0.00000034		<0.0000010		0.00000082
	Calcium (Ca)-Total (mg/dm2.day)	0.00636		0.00735		0.00507
	Chromium (Cr)-Total (mg/dm2.day)	0.0000405		0.000115		0.0000455
	Cobalt (Co)-Total (mg/dm2.day)	0.00000839		0.0000249		0.0000101
	Copper (Cu)-Total (mg/dm2.day)	0.000163		0.0000417		0.0000563
	Lead (Pb)-Total (mg/dm2.day)	0.00000216		0.0000055		0.00000523
	Lithium (Li)-Total (mg/dm2.day)	<0.000030		<0.00010		0.000042
	Magnesium (Mg)-Total (mg/dm2.day)	0.0154		0.0308		0.0158
	Manganese (Mn)-Total (mg/dm2.day)	0.000152		0.000627		0.000268
	Mercury (Hg)-Total (mg/dm2.day)	<0.00000030		<0.00000030		<0.00000030
	Molybdenum (Mo)-Total (mg/dm2.day)	0.00000172		<0.0000010		0.00000061
	Nickel (Ni)-Total (mg/dm2.day)	0.000105		0.000108		0.0000495
	Potassium (K)-Total (mg/dm2.day)	0.00808		0.0290		0.0431
	Selenium (Se)-Total (mg/dm2.day)	<0.0000050		<0.000030		<0.0000050
	Silver (Ag)-Total (mg/dm2.day)	0.000000136		<0.00000030		0.000000103
	Sodium (Na)-Total (mg/dm2.day)	0.00190		0.0040		0.00918
	Strontium (Sr)-Total (mg/dm2.day)	0.0000849		0.0000923		0.0000620
	Thallium (Tl)-Total (mg/dm2.day)	<0.00000050		<0.0000030		0.00000059
	Tin (Sn)-Total (mg/dm2.day)	0.00000066		<0.0000030		0.00000086
	Uranium (U)-Total (mg/dm2.day)	0.000000545		0.00000189		0.00000108
	Vanadium (V)-Total (mg/dm2.day)	0.0000203		0.000111		0.0000418
	Zinc (Zn)-Total (mg/dm2.day)	0.0000861		0.000148		0.000153

ALS LABORATORY GROUP ANALYTICAL REPORT

Sample ID Description Sampled Date Sampled Time Client ID		L538683-6	L538683-7	L538683-8	L538683-9	L538683-10
Grouping Analyte						
DUSTFALL						
Particulates	Total Dustfall (mg/m2.day)	2.51		21.6		5.62
	Total Insoluble Dustfall (mg/m2.day)	1.71		21.1		4.95
	Total Soluble Dustfall (mg/m2.day)	0.80		0.47		0.67
Total Metals	Aluminum (Al)-Total (mg/dm2.day)		0.0275		0.00117	
	Antimony (Sb)-Total (mg/dm2.day)		<0.0000050		0.00000051	
	Arsenic (As)-Total (mg/dm2.day)		<0.0000050		0.00000073	
	Barium (Ba)-Total (mg/dm2.day)		0.000518		0.0000254	
	Beryllium (Be)-Total (mg/dm2.day)		<0.000030		<0.0000030	
	Bismuth (Bi)-Total (mg/dm2.day)		<0.000030		<0.0000030	
	Boron (B)-Total (mg/dm2.day)		<0.00050		<0.000050	
	Cadmium (Cd)-Total (mg/dm2.day)		<0.0000030		0.00000144	
	Calcium (Ca)-Total (mg/dm2.day)		0.0054		0.00209	
	Chromium (Cr)-Total (mg/dm2.day)		0.000090		0.0000032	
	Cobalt (Co)-Total (mg/dm2.day)		0.0000192		0.00000096	
	Copper (Cu)-Total (mg/dm2.day)		0.0000464		0.0000478	
	Lead (Pb)-Total (mg/dm2.day)		0.0000054		0.00000228	
	Lithium (Li)-Total (mg/dm2.day)		<0.00030		<0.000030	
	Magnesium (Mg)-Total (mg/dm2.day)		0.0238		0.00268	
	Manganese (Mn)-Total (mg/dm2.day)		0.000475		0.0000439	
	Mercury (Hg)-Total (mg/dm2.day)		<0.00000030		<0.00000030	
	Molybdenum (Mo)-Total (mg/dm2.day)		<0.0000030		0.00000057	
	Nickel (Ni)-Total (mg/dm2.day)		0.000085		0.0000054	
	Potassium (K)-Total (mg/dm2.day)		0.0208		0.0165	
	Selenium (Se)-Total (mg/dm2.day)		<0.000050		<0.0000050	
	Silver (Ag)-Total (mg/dm2.day)		<0.00000050		0.000000272	
	Sodium (Na)-Total (mg/dm2.day)		<0.0030		0.00441	
	Strontium (Sr)-Total (mg/dm2.day)		0.0000650		0.0000121	
	Thallium (Tl)-Total (mg/dm2.day)		<0.0000050		<0.00000050	
	Tin (Sn)-Total (mg/dm2.day)		<0.0000050		0.00000085	
	Uranium (U)-Total (mg/dm2.day)		0.00000158		0.000000152	
	Vanadium (V)-Total (mg/dm2.day)		0.000085		<0.0000050	
	Zinc (Zn)-Total (mg/dm2.day)		0.000120		0.000178	

ALS LABORATORY GROUP ANALYTICAL REPORT

Sample ID Description Sampled Date Sampled Time Client ID		L538683-11	L538683-12	L538683-13	L538683-14	L538683-15
Grouping Analyte						
DUSTFALL						
Particulates	Total Dustfall (mg/m2.day)		0.52		2.41	
	Total Insoluble Dustfall (mg/m2.day)		0.44		1.53	
	Total Soluble Dustfall (mg/m2.day)		<0.10		0.88	
Total Metals	Aluminum (Al)-Total (mg/dm2.day)	0.0342		0.0211		0.0113
	Antimony (Sb)-Total (mg/dm2.day)	<0.0000030		<0.00000050		<0.00000050
	Arsenic (As)-Total (mg/dm2.day)	<0.0000030		0.00000152		0.00000129
	Barium (Ba)-Total (mg/dm2.day)	0.000652		0.000386		0.000238
	Beryllium (Be)-Total (mg/dm2.day)	<0.000010		<0.0000030		<0.0000030
	Bismuth (Bi)-Total (mg/dm2.day)	<0.000010		<0.0000030		<0.0000030
	Boron (B)-Total (mg/dm2.day)	<0.00030		<0.000050		<0.000050
	Cadmium (Cd)-Total (mg/dm2.day)	<0.0000010		0.00000097		0.00000161
	Calcium (Ca)-Total (mg/dm2.day)	0.0122		0.0110		0.00803
	Chromium (Cr)-Total (mg/dm2.day)	0.000128		0.0000807		0.0000519
	Cobalt (Co)-Total (mg/dm2.day)	0.0000288		0.0000182		0.0000114
	Copper (Cu)-Total (mg/dm2.day)	0.0000281		0.000248		0.000218
	Lead (Pb)-Total (mg/dm2.day)	0.0000037		0.00000422		0.00000254
	Lithium (Li)-Total (mg/dm2.day)	<0.00010		0.000041		<0.000030
	Magnesium (Mg)-Total (mg/dm2.day)	0.0412		0.0313		0.0220
	Manganese (Mn)-Total (mg/dm2.day)	0.000535		0.000493		0.000272
	Mercury (Hg)-Total (mg/dm2.day)	<0.00000030		<0.00000030		<0.00000030
	Molybdenum (Mo)-Total (mg/dm2.day)	0.0000026		0.00000171		0.00000163
	Nickel (Ni)-Total (mg/dm2.day)	0.000183		0.000112		0.000108
	Potassium (K)-Total (mg/dm2.day)	0.0245		0.0789		0.0489
	Selenium (Se)-Total (mg/dm2.day)	<0.000030		<0.0000050		<0.0000050
	Silver (Ag)-Total (mg/dm2.day)	<0.00000030		0.000000251		0.000000178
	Sodium (Na)-Total (mg/dm2.day)	0.0050		0.00647		0.00567
	Strontium (Sr)-Total (mg/dm2.day)	0.000154		0.0000864		0.0000785
	Thallium (Tl)-Total (mg/dm2.day)	<0.0000030		0.00000065		<0.00000050
	Tin (Sn)-Total (mg/dm2.day)	<0.0000030		0.00000071		<0.00000050
	Uranium (U)-Total (mg/dm2.day)	0.00000193		0.000000964		0.000000639
	Vanadium (V)-Total (mg/dm2.day)	0.000107		0.0000581		0.0000307
	Zinc (Zn)-Total (mg/dm2.day)	0.000140		0.000380		0.000280

ALS LABORATORY GROUP ANALYTICAL REPORT

		Sample ID Description Sampled Date Sampled Time Client ID	L538683-16	L538683-17	L538683-18	L538683-19	L538683-20
Grouping	Analyte						
DUSTFALL							
Particulates	Total Dustfall (mg/m2.day)		0.51		4.15	4.69	
	Total Insoluble Dustfall (mg/m2.day)		0.43		2.38	3.96	
	Total Soluble Dustfall (mg/m2.day)		<0.10		1.77	0.73	
Total Metals	Aluminum (Al)-Total (mg/dm2.day)			0.00539			0.0385
	Antimony (Sb)-Total (mg/dm2.day)			<0.00000050			<0.0000010
	Arsenic (As)-Total (mg/dm2.day)			0.00000097			0.0000016
	Barium (Ba)-Total (mg/dm2.day)			0.000112			0.000634
	Beryllium (Be)-Total (mg/dm2.day)			<0.0000030			<0.0000050
	Bismuth (Bi)-Total (mg/dm2.day)			<0.0000030			<0.0000050
	Boron (B)-Total (mg/dm2.day)			<0.000050			<0.00010
	Cadmium (Cd)-Total (mg/dm2.day)			<0.00000030			0.00000062
	Calcium (Ca)-Total (mg/dm2.day)			0.00499			0.00816
	Chromium (Cr)-Total (mg/dm2.day)			0.0000231			0.000108
	Cobalt (Co)-Total (mg/dm2.day)			0.00000546			0.0000237
	Copper (Cu)-Total (mg/dm2.day)			0.000147			0.0000412
	Lead (Pb)-Total (mg/dm2.day)			0.00000149			0.00000632
	Lithium (Li)-Total (mg/dm2.day)			<0.000030			0.000090
	Magnesium (Mg)-Total (mg/dm2.day)			0.0112			0.0306
	Manganese (Mn)-Total (mg/dm2.day)			0.000145			0.000606
	Mercury (Hg)-Total (mg/dm2.day)			<0.00000030			<0.00000030
	Molybdenum (Mo)-Total (mg/dm2.day)			0.00000103			0.00000081
	Nickel (Ni)-Total (mg/dm2.day)			0.0000561			0.000108
	Potassium (K)-Total (mg/dm2.day)			0.0490			0.0370
	Selenium (Se)-Total (mg/dm2.day)			<0.0000050			<0.000010
	Silver (Ag)-Total (mg/dm2.day)			0.000000063			0.00000020
	Sodium (Na)-Total (mg/dm2.day)			0.00316			0.00777
	Strontium (Sr)-Total (mg/dm2.day)			0.0000480			0.000116
	Thallium (Tl)-Total (mg/dm2.day)			<0.00000050			<0.0000010
	Tin (Sn)-Total (mg/dm2.day)			<0.00000050			0.0000012
	Uranium (U)-Total (mg/dm2.day)			0.000000391			0.00000230
	Vanadium (V)-Total (mg/dm2.day)			0.0000144			0.000101
	Zinc (Zn)-Total (mg/dm2.day)			0.000109			0.000202

ALS LABORATORY GROUP ANALYTICAL REPORT

		Sample ID				
		Description				
		Sampled Date				
		Sampled Time				
		Client ID				
Grouping	Analyte					
DUSTFALL						
Particulates	Total Dustfall (mg/m2.day)	17.9		18.6		1.77
	Total Insoluble Dustfall (mg/m2.day)	17.4		18.0		1.43
	Total Soluble Dustfall (mg/m2.day)	0.51		0.56		0.34
Total Metals	Aluminum (Al)-Total (mg/dm2.day)		0.0579		0.0381	
	Antimony (Sb)-Total (mg/dm2.day)		<0.0000010		<0.0000050	
	Arsenic (As)-Total (mg/dm2.day)		0.0000026		<0.0000050	
	Barium (Ba)-Total (mg/dm2.day)		0.000995		0.000738	
	Beryllium (Be)-Total (mg/dm2.day)		<0.0000050		<0.000030	
	Bismuth (Bi)-Total (mg/dm2.day)		<0.0000050		<0.000030	
	Boron (B)-Total (mg/dm2.day)		<0.00010		<0.00050	
	Cadmium (Cd)-Total (mg/dm2.day)		0.00000917		<0.0000030	
	Calcium (Ca)-Total (mg/dm2.day)		0.0217		0.0118	
	Chromium (Cr)-Total (mg/dm2.day)		0.000200		0.000145	
	Cobalt (Co)-Total (mg/dm2.day)		0.0000451		0.0000323	
	Copper (Cu)-Total (mg/dm2.day)		0.000165		0.0000398	
	Lead (Pb)-Total (mg/dm2.day)		0.00000640		0.0000044	
	Lithium (Li)-Total (mg/dm2.day)		0.000103		<0.00030	
	Magnesium (Mg)-Total (mg/dm2.day)		0.0738		0.0462	
	Manganese (Mn)-Total (mg/dm2.day)		0.000955		0.000635	
	Mercury (Hg)-Total (mg/dm2.day)		<0.00000030		<0.00000030	
	Molybdenum (Mo)-Total (mg/dm2.day)		0.00000544		<0.0000030	
	Nickel (Ni)-Total (mg/dm2.day)		0.000272		0.000198	
	Potassium (K)-Total (mg/dm2.day)		0.0960		0.0283	
	Selenium (Se)-Total (mg/dm2.day)		<0.000010		<0.000050	
	Silver (Ag)-Total (mg/dm2.day)		0.00000055		<0.00000050	
	Sodium (Na)-Total (mg/dm2.day)		0.0203		0.0045	
	Strontium (Sr)-Total (mg/dm2.day)		0.000217		0.000138	
	Thallium (Tl)-Total (mg/dm2.day)		0.0000018		<0.0000050	
	Tin (Sn)-Total (mg/dm2.day)		<0.0000010		<0.0000050	
	Uranium (U)-Total (mg/dm2.day)		0.00000246		0.00000156	
	Vanadium (V)-Total (mg/dm2.day)		0.000166		0.000124	
	Zinc (Zn)-Total (mg/dm2.day)		0.000735		0.000153	

ALS LABORATORY GROUP ANALYTICAL REPORT

Sample ID Description Sampled Date Sampled Time Client ID		L538683-26	L538683-27	L538683-28		
Grouping Analyte						
DUSTFALL						
Particulates	Total Dustfall (mg/m2.day)		1.26			
	Total Insoluble Dustfall (mg/m2.day)		0.48			
	Total Soluble Dustfall (mg/m2.day)		0.78			
Total Metals	Aluminum (Al)-Total (mg/dm2.day)	0.0315		0.000386		
	Antimony (Sb)-Total (mg/dm2.day)	<0.00000050		<0.00000050		
	Arsenic (As)-Total (mg/dm2.day)	0.00000183		0.00000059		
	Barium (Ba)-Total (mg/dm2.day)	0.000548		0.0000118		
	Beryllium (Be)-Total (mg/dm2.day)	<0.0000030		<0.0000030		
	Bismuth (Bi)-Total (mg/dm2.day)	<0.0000030		<0.0000030		
	Boron (B)-Total (mg/dm2.day)	<0.000050		<0.000050		
	Cadmium (Cd)-Total (mg/dm2.day)	0.00000072		0.00000129		
	Calcium (Ca)-Total (mg/dm2.day)	0.0122		0.00211		
	Chromium (Cr)-Total (mg/dm2.day)	0.000107		<0.0000030		
	Cobalt (Co)-Total (mg/dm2.day)	0.0000245		0.00000052		
	Copper (Cu)-Total (mg/dm2.day)	0.0000613		0.0000974		
	Lead (Pb)-Total (mg/dm2.day)	0.00000443		0.00000334		
	Lithium (Li)-Total (mg/dm2.day)	0.000057		<0.000030		
	Magnesium (Mg)-Total (mg/dm2.day)	0.0376		0.00269		
	Manganese (Mn)-Total (mg/dm2.day)	0.000449		0.0000295		
	Mercury (Hg)-Total (mg/dm2.day)	<0.00000030		<0.00000030		
	Molybdenum (Mo)-Total (mg/dm2.day)	0.00000357		0.00000059		
	Nickel (Ni)-Total (mg/dm2.day)	0.000173		0.0000062		
	Potassium (K)-Total (mg/dm2.day)	0.0343		0.0234		
	Selenium (Se)-Total (mg/dm2.day)	<0.0000050		<0.0000050		
	Silver (Ag)-Total (mg/dm2.day)	0.000000251		0.000000102		
	Sodium (Na)-Total (mg/dm2.day)	0.00996		0.00527		
	Strontium (Sr)-Total (mg/dm2.day)	0.000160		0.00000716		
	Thallium (Tl)-Total (mg/dm2.day)	0.00000060		<0.00000050		
	Tin (Sn)-Total (mg/dm2.day)	0.00000072		0.00000065		
	Uranium (U)-Total (mg/dm2.day)	0.00000132		0.000000058		
	Vanadium (V)-Total (mg/dm2.day)	0.0000862		<0.0000050		
	Zinc (Zn)-Total (mg/dm2.day)	0.000230		0.000141		

ALS LABORATORY GROUP ANALYTICAL REPORT

		Sample ID Description Sampled Date Sampled Time Client ID	L538683-2 01-AUG-07 16:03 AQ-49-P	L538683-4 01-AUG-07 18:14 MIS-U30-P	L538683-6 01-AUG-07 18:04 MIS-D300-P	L538683-8 01-AUG-07 17:50 MIS-D30-P	L538683-10 01-AUG-07 17:54 MIS-D90-P
Grouping	Analyte						
WATER							
Anions and Nutrients	Sulfate (SO4) (mg/L)	0.99	2.07	0.78	3.26	1.64	
	Nitrate (as N) (mg/L)	0.0135	0.0625	0.0261	0.317	0.0412	

ALS LABORATORY GROUP ANALYTICAL REPORT

		Sample ID Description Sampled Date Sampled Time Client ID	L538683-12 02-AUG-07 11:55 SAB-D300-P	L538683-14 02-AUG-07 11:37 SAB-D30-P	L538683-16 02-AUG-07 11:44 SAB-D90-P	L538683-18 02-AUG-07 11:25 SAB-U30-P	L538683-19 02-AUG-07 14:39 FOX-D90-P
Grouping	Analyte						
WATER							
Anions and Nutrients	Sulfate (SO4) (mg/L)	1.74	10.1	1.16	20.4	4.80	
	Nitrate (as N) (mg/L)	0.205	0.0266	0.169	0.0181	0.0101	

ALS LABORATORY GROUP ANALYTICAL REPORT

		Sample ID	L538683-21	L538683-23	L538683-25	L538683-27	
		Description					
		Sampled Date	02-AUG-07	02-AUG-07	02-AUG-07	02-AUG-07	
		Sampled Time	14:30	14:33	14:45	16:21	
		Client ID	FOX-U30-P	FOX-D30-P	FOX-D300-P	AQ-54-P	
Grouping	Analyte						
WATER							
Anions and Nutrients	Sulfate (SO4) (mg/L)	7.47	9.37	1.84	<0.50		
	Nitrate (as N) (mg/L)	0.269	0.246	0.210	0.150		

Reference Information

Methods Listed (if applicable):

ALS Test Code	Matrix	Test Description	Analytical Method Reference(Based On)
ANIONS-NO3-IC-VA	Water	Nitrate by Ion Chromatography	APHA 4110 "Determination of Anions by IC
This analysis is carried out using procedures adapted from APHA Method 4110 "Determination of Anions by Ion Chromatography" and EPA Method 300.0 "Determination of Inorganic Anions by Ion Chromatography". Anions routinely determined by this method include: bromide, chloride, fluoride, nitrate, nitrite and sulphate.			
ANIONS-SO4-IC-VA	Water	Sulfate by Ion Chromatography	APHA 4110 "Determination of Anions by IC
This analysis is carried out using procedures adapted from APHA Method 4110 "Determination of Anions by Ion Chromatography" and EPA Method 300.0 "Determination of Inorganic Anions by Ion Chromatography". Anions routinely determined by this method include: bromide, chloride, fluoride, nitrate, nitrite and sulphate.			
DUSTFALLS-COM-DM2-VA	Dustfall	Combined dustfalls-Total, soluble, insol	BCMOE "DUSTFALLS"
Dustfall analysis is carried out in accordance with procedures published by the B.C. Ministry of Environment Laboratory.			
HG-DUST(DM2-CVAFS-VA)	Dustfall	Total Mercury in Dustfalls by CVAFS	EPA 245.7
This analysis is carried out using procedures adapted from "Standard Methods for the Examination of Water and Wastewater" published by the American Public Health Association, and with procedures adapted from "Test Methods for Evaluating Solid Waste" SW-846 published by the United States Environmental Protection Agency (EPA). Instrumental analysis is by cold vapour atomic fluorescence spectrophotometry (EPA Method 245.7).			
MET-DUST(DM2)-MS-VA	Dustfall	Total Metals in Dustfalls by ICPMS	EPA 6020A
This analysis is carried out using procedures adapted from "Standard Methods for the Examination of Water and Wastewater" published by the American Public Health Association, and with procedures adapted from "Test Methods for Evaluating Solid Waste" SW-846 published by the United States Environmental Protection Agency (EPA). Instrumental analysis is by inductively coupled plasma - mass spectrometry (EPA Method 6020A).			
** Laboratory Methods employed follow in-house procedures, which are generally based on nationally or internationally accepted methodologies. The last two letters of the above ALS Test Code column indicate the laboratory that performed analytical analysis for that test. Refer to the list below:			
Laboratory Definition Code	Laboratory Location	Laboratory Definition Code	Laboratory Location
VA	ALS LABORATORY GROUP - VANCOUVER, BC, CANADA		

GLOSSARY OF REPORT TERMS

Surr - A surrogate is an organic compound that is similar to the target analyte(s) in chemical composition and behavior but not normally detected in environmental samples. Prior to sample processing, samples are fortified with one or more surrogate compounds.

The reported surrogate recovery value provides a measure of method efficiency.

mg/kg (units) - unit of concentration based on mass, parts per million

mg/L (units) - unit of concentration based on volume, parts per million

N/A - Result not available. Refer to qualifier code and definition for explanation

Test results reported relate only to the samples as received by the laboratory.

UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.

Although test results are generated under strict QA/QC protocols, any unsigned test reports, faxes, or emails are considered preliminary.

ALS Laboratory Group has an extensive QA/QC program where all analytical data reported is analyzed using approved referenced procedures followed by checks and reviews by senior managers and quality assurance personnel. However, since the results are obtained from chemical measurements and thus cannot be guaranteed, ALS Laboratory Group assumes no liability for the use or interpretation of the results.

ALS Environmental

excellence in analytical testing



1988 Triumph Street, Vancouver, BC V5L 1K5
Tel: 604-253-4188 Toll Free: 1-800-665-0243 Fax: 604-253-6700
ALS Contact: Can Dang

CHAIN OF CUSTODY FORM

Form 10842

BHP Billiton Diamonds Inc.
1102 4920 52nd Street, Yellowknife, NT X1A 3T1
Tel: 867-880-2157 Fax: 867-880-4012
BHP Contacts: Karen Hosford/Rob MacLean



For Lab Use

1538683

Station ID	Matrix	Date	Time	Init	Dustfall Metals	Insoluble Particulate	Nitrate	Soluble Particulate	Sulphate	Total Particulate
Fox-U30-P	Dust	8/2/2007	2:30:00 PM	JB	1	1	1	1	1	BHP2
Fox-D90-M	Dust	8/2/2007	2:41:00 PM	JB	1	1	1	1	1	BHP2
Fox-D30-P	Dust	8/2/2007	2:33:00 PM	JB	1	1	1	1	1	BHP2
Fox-D30-M	Dust	8/2/2007	2:34:00 PM	JB	1	1	1	1	1	BHP2
Fox-D300-P	Dust	8/2/2007	2:45:00 PM	JB	1	1	1	1	1	BHP2
Fox-D300-M	Dust	8/2/2007	2:47:00 PM	JB	1	1	1	1	1	BHP2
AQ-54-P	Dust	8/1/2007	4:21:00 PM	JB	1	1	1	1	1	BHP2
AQ-54-M	Dust	8/1/2007	4:18:00 PM	JB	1	1	1	1	1	BHP2

Turn around Required: _____

Special Instructions (Billing details, QC reporting, etc.): _____

Billing Code: BHP2503

Relinquished by:	Date	Received by:	Date
	Time	HD	07/07/08
Relinquished by:	Date	Received by:	Date
	Time		10:50

FOR LAB USE ONLY

Cooler seal intact upon receipt? ☒ Yes ☐ No ☐ N/A

Sample temperature upon receipt: ☒ Frozen? ☐ Yes ☐ No

Send Analytical Results to:

compliance.team@bhpbilliton.com



CHAIN OF CUSTODY FORM

LS30683

Station ID	Matrix	Date	Time	Init	Dustfall Metals	Insoluble Particulate	Nitrate	Soluble Particulate	Sulphate	Total Particulate
Sab-D300-M	Dust	8/1/2007	11:56:00 A	JB	1	1	1	1	1	BHP2
AQ-49-P	Dust	8/1/2007	4:03:00 PM	JB	1	1	1	1	1	BHP2
Mis-U30-M	Dust	8/1/2007	6:11:00 PM	JB	1	1	1	1	1	BHP2
Mis-U30-P	Dust	8/1/2007	6:14:00 PM	JB	1	1	1	1	1	BHP2
Mis-D300-M	Dust	8/1/2007	6:06:00 PM	JB	1	1	1	1	1	BHP2
Mis-D300-P	Dust	8/1/2007	6:04:00 PM	JB	1	1	1	1	1	BHP2
Mis-D30-M	Dust	8/1/2007	5:50:00 PM	JB	1	1	1	1	1	BHP2
Mis-D30-P	Dust	8/1/2007	5:50:00 PM	JB	1	1	1	1	1	BHP2
AQ-49-M	Dust	8/1/2007	4:00:00 PM	JB	1	1	1	1	1	BHP2
Mis-D90-P	Dust	8/1/2007	5:54:00 PM	JB	1	1	1	1	1	BHP2
Fox-U30-M	Dust	8/1/2007	2:27:00 PM	JB	1	1	1	1	1	BHP2
Sab-D300-P	Dust	8/1/2007	11:55:00 A	JB	1	1	1	1	1	BHP2
Sab-D30-M	Dust	8/1/2007	11:39:00 A	JB	1	1	1	1	1	BHP2
Sab-D30-P	Dust	8/1/2007	11:37:00 A	JB	1	1	1	1	1	BHP2
Sab-D90-M	Dust	8/1/2007	11:42:00 A	JB	1	1	1	1	1	BHP2
Sab-D90-P	Dust	8/1/2007	11:44:00 A	JB	1	1	1	1	1	BHP2
Sab-U30-M	Dust	8/1/2007	11:24:00 A	JB	1	1	1	1	1	BHP2
Sab-U30-P	Dust	8/1/2007	11:25:00 A	JB	1	1	1	1	1	BHP2
Fox-D90-P	Dust	8/1/2007	2:39:00 PM	JB	1	1	1	1	1	BHP2
Mis-D90-M	Dust	8/1/2007	5:51:00 PM	JB	1	1	1	1	1	BHP2

FOR LAB USE ONLY

Turn around Required: _____

Special Instructions (Billing details, QC reporting, etc): _____

Billing Code: BHP2503

compliance.team@bhpbilliton.com

Cooler seal intact upon receipt? ☐ Yes ☒ No ☐ N/A

Sample temperature upon receipt: ☐ Frozen? ☐ Yes ☒ No

Send Analytical Results to:

Relinquished by:	Date	Received by:	Date
	Time		Time
Relinquished by:	Date	Received by:	Date
	Time		Time

FOR LAB USE ONLY



Environmental Division

ANALYTICAL REPORT

BHP BILLITON DIAMONDS INC.

ATTN: KAREN HOSFORD

Reported On: 09-OCT-07 04:12 PM

1102 - 4920 52ND STREET

YELLOWKNIFE NT X1A 3T1

Lab Work Order #: L551507

Date Received: 07-SEP-07

Project P.O. #: BHP2503

Job Reference: 10881

Legal Site Desc: 6200296543

CofC Numbers: 10881

Other Information:

Comments: Due to labs error, insufficient sample volume was prepared. Hence the nutrients analyses were not performed on the dustfall samples as requested.

Timothy Guy Crowther
General Manager, Vancouver

For any questions about this report please contact your Account Manager:

Can Dang

THIS REPORT SHALL NOT BE REPRODUCED EXCEPT IN FULL WITHOUT THE WRITTEN AUTHORITY OF THE LABORATORY.
ALL SAMPLES WILL BE DISPOSED OF AFTER 30 DAYS FOLLOWING ANALYSIS. PLEASE CONTACT THE LAB IF YOU
REQUIRE ADDITIONAL SAMPLE STORAGE TIME.

ALS LABORATORY GROUP ANALYTICAL REPORT

Sample ID Description Sampled Date Sampled Time Client ID		L551507-1	L551507-2	L551507-3	L551507-4	L551507-5
		02-SEP-07 15:15 SAB-D300-M	01-SEP-07 13:50 AQ-49-P	01-SEP-07 17:48 MIS-U30-M	01-SEP-07 17:48 MIS-U30-P	01-SEP-07 17:48 MIS-D300-M
Grouping	Analyte					
DUSTFALL						
Particulates	Total Dustfall (mg/dm2.day)		<0.10		14.9	
	Total Insoluble Dustfall (mg/dm2.day)		<0.10		14.9	
	Total Soluble Dustfall (mg/dm2.day)		<0.10		<0.10	
Total Metals	Aluminum (Al)-Total (mg/dm2.day)	0.000464		0.0176		0.0108
	Antimony (Sb)-Total (mg/dm2.day)	<0.00000020		<0.0000010		<0.00000020
	Arsenic (As)-Total (mg/dm2.day)	0.00000037		<0.0000010		0.00000071
	Barium (Ba)-Total (mg/dm2.day)	0.0000164		0.000289		0.000175
	Beryllium (Be)-Total (mg/dm2.day)	<0.0000010		<0.0000050		<0.0000010
	Bismuth (Bi)-Total (mg/dm2.day)	<0.0000010		<0.0000050		<0.0000010
	Boron (B)-Total (mg/dm2.day)	<0.000020		<0.00010		<0.000020
	Cadmium (Cd)-Total (mg/dm2.day)	<0.00000010		<0.00000050		<0.00000010
	Calcium (Ca)-Total (mg/dm2.day)	0.000462		0.00404		0.00281
	Chromium (Cr)-Total (mg/dm2.day)	0.0000096		0.0000476		0.0000302
	Cobalt (Co)-Total (mg/dm2.day)	0.00000050		0.0000108		0.00000670
	Copper (Cu)-Total (mg/dm2.day)	0.0000360		0.0000219		0.0000522
	Lead (Pb)-Total (mg/dm2.day)	0.00000089		0.00000345		0.00000245
	Lithium (Li)-Total (mg/dm2.day)	<0.000010		<0.000050		0.000027
	Magnesium (Mg)-Total (mg/dm2.day)	0.000634		0.0139		0.00830
	Manganese (Mn)-Total (mg/dm2.day)	0.0000135		0.000293		0.000169
	Mercury (Hg)-Total (mg/dm2.day)	<0.00000010		<0.00000010		<0.00000010
	Molybdenum (Mo)-Total (mg/dm2.day)	<0.00000010		<0.00000050		0.00000025
	Nickel (Ni)-Total (mg/dm2.day)	0.0000036		0.0000497		0.0000345
	Potassium (K)-Total (mg/dm2.day)	0.00049		0.0107		0.00730
	Selenium (Se)-Total (mg/dm2.day)	<0.0000020		<0.000010		<0.0000020
	Silver (Ag)-Total (mg/dm2.day)	<0.000000020		<0.00000010		0.000000043
	Sodium (Na)-Total (mg/dm2.day)	0.00020		0.00210		0.00171
	Strontium (Sr)-Total (mg/dm2.day)	0.00000374		0.0000534		0.0000392
	Thallium (Tl)-Total (mg/dm2.day)	<0.00000020		<0.0000010		0.00000026
	Tin (Sn)-Total (mg/dm2.day)	0.00000032		<0.0000010		0.00000066
	Uranium (U)-Total (mg/dm2.day)	0.000000027		0.00000126		0.000000667
	Vanadium (V)-Total (mg/dm2.day)	<0.0000020		0.000044		0.0000277
	Zinc (Zn)-Total (mg/dm2.day)	0.0000144		0.000065		0.0000447

ALS LABORATORY GROUP ANALYTICAL REPORT

Sample ID Description Sampled Date Sampled Time Client ID		L551507-6	L551507-7	L551507-8	L551507-9	L551507-10
Grouping Analyte						
DUSTFALL						
Particulates	Total Dustfall (mg/dm2.day)	0.69		16.2		2.84
	Total Insoluble Dustfall (mg/dm2.day)	0.69		16.2		2.84
	Total Soluble Dustfall (mg/dm2.day)	<0.10		<0.10		<0.10
Total Metals	Aluminum (Al)-Total (mg/dm2.day)		0.0198		0.0000890	
	Antimony (Sb)-Total (mg/dm2.day)		<0.0000010		<0.00000020	
	Arsenic (As)-Total (mg/dm2.day)		0.0000013		0.00000022	
	Barium (Ba)-Total (mg/dm2.day)		0.000410		0.00000319	
	Beryllium (Be)-Total (mg/dm2.day)		<0.0000050		<0.0000010	
	Bismuth (Bi)-Total (mg/dm2.day)		<0.0000050		<0.0000010	
	Boron (B)-Total (mg/dm2.day)		<0.00010		<0.000020	
	Cadmium (Cd)-Total (mg/dm2.day)		<0.00000050		<0.00000010	
	Calcium (Ca)-Total (mg/dm2.day)		0.00607		0.000200	
	Chromium (Cr)-Total (mg/dm2.day)		0.0000532		<0.0000010	
	Cobalt (Co)-Total (mg/dm2.day)		0.0000130		<0.00000020	
	Copper (Cu)-Total (mg/dm2.day)		0.0000268		0.0000520	
	Lead (Pb)-Total (mg/dm2.day)		0.00000558		0.00000029	
	Lithium (Li)-Total (mg/dm2.day)		<0.000050		<0.000010	
	Magnesium (Mg)-Total (mg/dm2.day)		0.0165		0.000124	
	Manganese (Mn)-Total (mg/dm2.day)		0.000368		0.00000567	
	Mercury (Hg)-Total (mg/dm2.day)		<0.00000010		<0.00000010	
	Molybdenum (Mo)-Total (mg/dm2.day)		<0.00000050		<0.00000010	
	Nickel (Ni)-Total (mg/dm2.day)		0.0000714		<0.0000010	
	Potassium (K)-Total (mg/dm2.day)		0.0145		0.00013	
	Selenium (Se)-Total (mg/dm2.day)		<0.000010		<0.0000020	
	Silver (Ag)-Total (mg/dm2.day)		<0.00000010		<0.000000020	
	Sodium (Na)-Total (mg/dm2.day)		0.00211		0.00013	
	Strontium (Sr)-Total (mg/dm2.day)		0.0000622		0.00000072	
	Thallium (Tl)-Total (mg/dm2.day)		<0.0000010		<0.00000020	
	Tin (Sn)-Total (mg/dm2.day)		<0.0000010		<0.00000020	
	Uranium (U)-Total (mg/dm2.day)		0.00000217		<0.000000020	
	Vanadium (V)-Total (mg/dm2.day)		0.000048		<0.0000020	
	Zinc (Zn)-Total (mg/dm2.day)		0.000077		0.0000033	

ALS LABORATORY GROUP ANALYTICAL REPORT

Sample ID Description Sampled Date Sampled Time Client ID		L551507-11	L551507-12	L551507-13	L551507-14	L551507-15
		01-SEP-07 15:37 FOX-U30-M	02-SEP-07 15:15 SAB-D300-P	02-SEP-07 15:15 SAB-D30-M	02-SEP-07 15:15 SAB-D30-P	02-SEP-07 15:15 SAB-D90-M
Grouping	Analyte					
DUSTFALL						
Particulates	Total Dustfall (mg/dm2.day)		<0.10		<0.10	
	Total Insoluble Dustfall (mg/dm2.day)		<0.10		<0.10	
	Total Soluble Dustfall (mg/dm2.day)		<0.10		<0.10	
Total Metals	Aluminum (Al)-Total (mg/dm2.day)	0.0142		0.00254		0.000537
	Antimony (Sb)-Total (mg/dm2.day)	<0.00000020		<0.00000020		<0.00000020
	Arsenic (As)-Total (mg/dm2.day)	0.00000091		0.00000055		0.00000036
	Barium (Ba)-Total (mg/dm2.day)	0.000250		0.0000810		0.0000200
	Beryllium (Be)-Total (mg/dm2.day)	<0.0000010		<0.0000010		<0.0000010
	Bismuth (Bi)-Total (mg/dm2.day)	<0.0000010		<0.0000010		<0.0000010
	Boron (B)-Total (mg/dm2.day)	<0.000020		<0.000020		<0.000020
	Cadmium (Cd)-Total (mg/dm2.day)	0.00000013		0.00000019		<0.00000010
	Calcium (Ca)-Total (mg/dm2.day)	0.0105		0.00283		0.000590
	Chromium (Cr)-Total (mg/dm2.day)	0.0000552		0.0000142		0.0000040
	Cobalt (Co)-Total (mg/dm2.day)	0.0000122		0.00000240		0.00000060
	Copper (Cu)-Total (mg/dm2.day)	0.0000789		0.0000451		0.0000323
	Lead (Pb)-Total (mg/dm2.day)	0.00000289		0.00000131		0.00000081
	Lithium (Li)-Total (mg/dm2.day)	0.000022		<0.000010		<0.000010
	Magnesium (Mg)-Total (mg/dm2.day)	0.0203		0.00412		0.000650
	Manganese (Mn)-Total (mg/dm2.day)	0.000237		0.0000988		0.0000169
	Mercury (Hg)-Total (mg/dm2.day)	<0.00000010		<0.00000010		<0.00000010
	Molybdenum (Mo)-Total (mg/dm2.day)	0.00000268		0.00000060		0.00000013
	Nickel (Ni)-Total (mg/dm2.day)	0.000100		0.0000134		0.0000049
	Potassium (K)-Total (mg/dm2.day)	0.101		0.0178		0.00070
	Selenium (Se)-Total (mg/dm2.day)	0.0000107		<0.0000020		<0.0000020
	Silver (Ag)-Total (mg/dm2.day)	0.000000042		0.000000033		<0.000000020
	Sodium (Na)-Total (mg/dm2.day)	0.0344		0.00123		0.00024
	Strontium (Sr)-Total (mg/dm2.day)	0.0000887		0.0000186		0.00000375
	Thallium (Tl)-Total (mg/dm2.day)	0.00000028		<0.00000020		<0.00000020
	Tin (Sn)-Total (mg/dm2.day)	<0.00000020		0.00000058		<0.00000020
	Uranium (U)-Total (mg/dm2.day)	0.000000817		0.000000143		0.000000028
	Vanadium (V)-Total (mg/dm2.day)	0.0000388		0.0000080		<0.0000020
	Zinc (Zn)-Total (mg/dm2.day)	0.000264		0.0000665		0.0000153

ALS LABORATORY GROUP ANALYTICAL REPORT

Sample ID Description Sampled Date Sampled Time Client ID		L551507-16	L551507-17	L551507-18	L551507-19	L551507-20
Grouping Analyte						
DUSTFALL						
Particulates	Total Dustfall (mg/dm2.day)	<0.10		<0.10	2.16	
	Total Insoluble Dustfall (mg/dm2.day)	<0.10		<0.10	2.16	
	Total Soluble Dustfall (mg/dm2.day)	<0.10		<0.10	<0.10	
Total Metals	Aluminum (Al)-Total (mg/dm2.day)		0.00235			0.0216
	Antimony (Sb)-Total (mg/dm2.day)		<0.00000020			<0.00000040
	Arsenic (As)-Total (mg/dm2.day)		0.00000041			0.00000113
	Barium (Ba)-Total (mg/dm2.day)		0.0000531			0.000344
	Beryllium (Be)-Total (mg/dm2.day)		<0.0000010			<0.0000020
	Bismuth (Bi)-Total (mg/dm2.day)		<0.0000010			<0.0000020
	Boron (B)-Total (mg/dm2.day)		<0.000020			<0.000040
	Cadmium (Cd)-Total (mg/dm2.day)		<0.00000010			<0.00000020
	Calcium (Ca)-Total (mg/dm2.day)		0.00158			0.00512
	Chromium (Cr)-Total (mg/dm2.day)		0.0000118			0.0000622
	Cobalt (Co)-Total (mg/dm2.day)		0.00000210			0.0000125
	Copper (Cu)-Total (mg/dm2.day)		0.0000305			0.0000433
	Lead (Pb)-Total (mg/dm2.day)		0.00000165			0.00000527
	Lithium (Li)-Total (mg/dm2.day)		<0.000010			0.000053
	Magnesium (Mg)-Total (mg/dm2.day)		0.00280			0.0164
	Manganese (Mn)-Total (mg/dm2.day)		0.0000615			0.000334
	Mercury (Hg)-Total (mg/dm2.day)		<0.00000010			<0.00000010
	Molybdenum (Mo)-Total (mg/dm2.day)		0.00000037			0.00000039
	Nickel (Ni)-Total (mg/dm2.day)		0.0000115			0.0000618
	Potassium (K)-Total (mg/dm2.day)		0.00475			0.0123
	Selenium (Se)-Total (mg/dm2.day)		<0.0000020			<0.0000040
	Silver (Ag)-Total (mg/dm2.day)		<0.000000020			0.000000066
	Sodium (Na)-Total (mg/dm2.day)		0.00034			0.00292
	Strontium (Sr)-Total (mg/dm2.day)		0.0000109			0.0000698
	Thallium (Tl)-Total (mg/dm2.day)		<0.00000020			0.00000048
	Tin (Sn)-Total (mg/dm2.day)		0.00000034			0.00000080
	Uranium (U)-Total (mg/dm2.day)		0.000000229			0.00000150
	Vanadium (V)-Total (mg/dm2.day)		0.0000074			0.0000507
	Zinc (Zn)-Total (mg/dm2.day)		0.0000466			0.0000742

ALS LABORATORY GROUP ANALYTICAL REPORT

Sample ID Description Sampled Date Sampled Time Client ID		L551507-21	L551507-22	L551507-23	L551507-24	L551507-25
Grouping Analyte						
DUSTFALL						
Particulates	Total Dustfall (mg/dm2.day)	10.2		6.40		1.03
	Total Insoluble Dustfall (mg/dm2.day)	9.96		6.33		1.03
	Total Soluble Dustfall (mg/dm2.day)	0.20		<0.10		<0.10
Total Metals	Aluminum (Al)-Total (mg/dm2.day)		0.0231		0.0176	
	Antimony (Sb)-Total (mg/dm2.day)		<0.00000040		<0.00000020	
	Arsenic (As)-Total (mg/dm2.day)		0.00000105		<0.00000020	
	Barium (Ba)-Total (mg/dm2.day)		0.000424		0.000355	
	Beryllium (Be)-Total (mg/dm2.day)		<0.00000020		<0.0000010	
	Bismuth (Bi)-Total (mg/dm2.day)		<0.00000020		<0.0000010	
	Boron (B)-Total (mg/dm2.day)		<0.0000040		<0.0000020	
	Cadmium (Cd)-Total (mg/dm2.day)		<0.000000020		<0.00000010	
	Calcium (Ca)-Total (mg/dm2.day)		0.00701		0.00605	
	Chromium (Cr)-Total (mg/dm2.day)		0.0000819		0.000068	
	Cobalt (Co)-Total (mg/dm2.day)		0.0000176		0.0000155	
	Copper (Cu)-Total (mg/dm2.day)		0.0000390		0.0000211	
	Lead (Pb)-Total (mg/dm2.day)		0.00000276		0.0000022	
	Lithium (Li)-Total (mg/dm2.day)		0.000042		<0.0000010	
	Magnesium (Mg)-Total (mg/dm2.day)		0.0275		0.0239	
	Manganese (Mn)-Total (mg/dm2.day)		0.000352		0.000291	
	Mercury (Hg)-Total (mg/dm2.day)		<0.000000010		<0.000000010	
	Molybdenum (Mo)-Total (mg/dm2.day)		0.00000118		0.0000011	
	Nickel (Ni)-Total (mg/dm2.day)		0.000114		0.000108	
	Potassium (K)-Total (mg/dm2.day)		0.0144		0.0116	
	Selenium (Se)-Total (mg/dm2.day)		<0.00000040		<0.00000020	
	Silver (Ag)-Total (mg/dm2.day)		<0.0000000040		<0.000000020	
	Sodium (Na)-Total (mg/dm2.day)		0.00292		0.0019	
	Strontium (Sr)-Total (mg/dm2.day)		0.0000914		0.0000699	
	Thallium (Tl)-Total (mg/dm2.day)		<0.000000040		<0.00000020	
	Tin (Sn)-Total (mg/dm2.day)		0.00000064		<0.00000020	
	Uranium (U)-Total (mg/dm2.day)		0.00000104		0.00000105	
	Vanadium (V)-Total (mg/dm2.day)		0.0000655		0.000054	
	Zinc (Zn)-Total (mg/dm2.day)		0.0000809		0.000063	

ALS LABORATORY GROUP ANALYTICAL REPORT

Sample ID Description Sampled Date Sampled Time Client ID		L551507-26	L551507-27	L551507-28		
Grouping Analyte						
DUSTFALL						
Particulates	Total Dustfall (mg/dm2.day)		<0.10			
	Total Insoluble Dustfall (mg/dm2.day)		<0.10			
	Total Soluble Dustfall (mg/dm2.day)		<0.10			
Total Metals	Aluminum (Al)-Total (mg/dm2.day)	0.0334		0.000237		
	Antimony (Sb)-Total (mg/dm2.day)	<0.00000020		<0.00000020		
	Arsenic (As)-Total (mg/dm2.day)	0.00000188		0.00000026		
	Barium (Ba)-Total (mg/dm2.day)	0.000519		0.00000616		
	Beryllium (Be)-Total (mg/dm2.day)	<0.0000010		<0.0000010		
	Bismuth (Bi)-Total (mg/dm2.day)	<0.0000010		<0.0000010		
	Boron (B)-Total (mg/dm2.day)	<0.000020		<0.000020		
	Cadmium (Cd)-Total (mg/dm2.day)	<0.00000010		<0.00000010		
	Calcium (Ca)-Total (mg/dm2.day)	0.0134		0.000291		
	Chromium (Cr)-Total (mg/dm2.day)	0.000143		0.0000027		
	Cobalt (Co)-Total (mg/dm2.day)	0.0000284		0.00000028		
	Copper (Cu)-Total (mg/dm2.day)	0.0000828		0.0000521		
	Lead (Pb)-Total (mg/dm2.day)	0.00000349		0.00000030		
	Lithium (Li)-Total (mg/dm2.day)	0.000057		<0.000010		
	Magnesium (Mg)-Total (mg/dm2.day)	0.0382		0.000303		
	Manganese (Mn)-Total (mg/dm2.day)	0.000604		0.0000107		
	Mercury (Hg)-Total (mg/dm2.day)	<0.00000010		<0.00000010		
	Molybdenum (Mo)-Total (mg/dm2.day)	0.00000168		0.00000017		
	Nickel (Ni)-Total (mg/dm2.day)	0.000190		0.0000026		
	Potassium (K)-Total (mg/dm2.day)	0.0237		0.00032		
	Selenium (Se)-Total (mg/dm2.day)	<0.0000020		<0.0000020		
	Silver (Ag)-Total (mg/dm2.day)	0.000000067		<0.000000020		
	Sodium (Na)-Total (mg/dm2.day)	0.00467		0.00016		
	Strontium (Sr)-Total (mg/dm2.day)	0.000162		0.00000119		
	Thallium (Tl)-Total (mg/dm2.day)	0.00000056		<0.00000020		
	Tin (Sn)-Total (mg/dm2.day)	0.00000088		0.00000082		
	Uranium (U)-Total (mg/dm2.day)	0.00000112		<0.000000020		
	Vanadium (V)-Total (mg/dm2.day)	0.000111		<0.0000020		
	Zinc (Zn)-Total (mg/dm2.day)	0.000135		0.0000115		

Reference Information

Methods Listed (if applicable):

ALS Test Code	Matrix	Test Description	Analytical Method Reference(Based On)
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DUSTFALLS-COM-DM2-VA Dustfall Combined dustfalls-Total, soluble, insol BCME "DUSTFALLS"

Dustfall analysis is carried out in accordance with procedures published by the B.C. Ministry of Environment Laboratory.

HG-DUST(DM2-CVAFS-VA) Dustfall Total Mercury in Dustfalls by CVAFS EPA 245.7

This analysis is carried out using procedures adapted from "Standard Methods for the Examination of Water and Wastewater" published by the American Public Health Association, and with procedures adapted from "Test Methods for Evaluating Solid Waste" SW-846 published by the United States Environmental Protection Agency (EPA). Instrumental analysis is by cold vapour atomic fluorescence spectrophotometry (EPA Method 245.7).

MET-DUST(DM2)-MS-VA Dustfall Total Metals in Dustfalls by ICPMS EPA 6020A

This analysis is carried out using procedures adapted from "Standard Methods for the Examination of Water and Wastewater" published by the American Public Health Association, and with procedures adapted from "Test Methods for Evaluating Solid Waste" SW-846 published by the United States Environmental Protection Agency (EPA). Instrumental analysis is by inductively coupled plasma - mass spectrometry (EPA Method 6020A).

** Laboratory Methods employed follow in-house procedures, which are generally based on nationally or internationally accepted methodologies. The last two letters of the above ALS Test Code column indicate the laboratory that performed analytical analysis for that test. Refer to the list below:

Laboratory Definition Code	Laboratory Location	Laboratory Definition Code	Laboratory Location
VA	ALS LABORATORY GROUP - VANCOUVER, BC, CANADA		

GLOSSARY OF REPORT TERMS

Surr - A surrogate is an organic compound that is similar to the target analyte(s) in chemical composition and behavior but not normally detected in environmental samples. Prior to sample processing, samples are fortified with one or more surrogate compounds.

The reported surrogate recovery value provides a measure of method efficiency.

mg/kg (units) - unit of concentration based on mass, parts per million

mg/L (units) - unit of concentration based on volume, parts per million

N/A - Result not available. Refer to qualifier code and definition for explanation

Test results reported relate only to the samples as received by the laboratory.

UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.

Although test results are generated under strict QA/QC protocols, any unsigned test reports, faxes, or emails are considered preliminary.

ALS Laboratory Group has an extensive QA/QC program where all analytical data reported is analyzed using approved referenced procedures followed by checks and reviews by senior managers and quality assurance personnel. However, since the results are obtained from chemical measurements and thus cannot be guaranteed, ALS Laboratory Group assumes no liability for the use or interpretation of the results.



ALS Environmental
excellence in analytical testing

1988 Triumph Street, Vancouver, BC V5L 1K5
Tel: 604-253-4188 Toll Free: 1-800-665-0243 Fax: 604-253-6700
ALS Contact: Can Dang

Form 10881



bhpbilliton

BHP Billiton Diamonds Inc.
1102 4920 52nd Street, Yellowknife, NT X1A 3T1
Tel: 867-880-2157 Fax: 867-880-4012
BHP Contacts: Karen Hosford/Rob MacLean

CHAIN OF CUSTODY FORM

Station ID	Matrix	Date	Time	Init	Dustfall Metals	Insoluble Particulate	Nitrate	Soluble Particulate	Sulphate	Total Particulate
Sab-D300-M	Dust	9/2/2007	3:15:00 PM	JS	1	1	1	1	1	BHP2
AQ-49-P	Dust	9/1/2007	1:50:00 PM	JS	1	1	1	1	1	BHP2
Mis-U30-M	Dust	9/1/2007	5:48:00 PM	JS	1	1	1	1	1	BHP2
Mis-U30-P	Dust	9/1/2007	5:48:00 PM	JS	1	1	1	1	1	BHP2
Mis-D300-M	Dust	9/1/2007	5:48:00 PM	JS	1	1	1	1	1	BHP2
Mis-D300-P	Dust	9/1/2007	5:48:00 PM	JS	1	1	1	1	1	BHP2
Mis-D30-M	Dust	9/1/2007	5:48:00 PM	JS	1	1	1	1	1	BHP2
Mis-D30-P	Dust	9/1/2007	5:48:00 PM	JS	1	1	1	1	1	BHP2
AQ-49-M	Dust	9/1/2007	1:50:00 PM	JS	1	1	1	1	1	BHP2
Mis-D90-P	Dust	9/1/2007	5:48:00 PM	JS	1	1	1	1	1	BHP2
Fox-U30-M	Dust	9/1/2007	3:37:00 PM	JS	1	1	1	1	1	BHP2
Sab-D300-P	Dust	9/2/2007	3:15:00 PM	JS	1	1	1	1	1	BHP2
Sab-D30-M	Dust	9/2/2007	3:15:00 PM	JS	1	1	1	1	1	BHP2
Sab-D90-M	Dust	9/2/2007	3:15:00 PM	JS	1	1	1	1	1	BHP2
Sab-D90-P	Dust	9/2/2007	3:15:00 PM	JS	1	1	1	1	1	BHP2
Sab-U30-M	Dust	9/2/2007	3:15:00 PM	JS	1	1	1	1	1	BHP2
Sab-U30-P	Dust	9/2/2007	3:15:00 PM	JS	1	1	1	1	1	BHP2
Fox-D90-P	Dust	9/1/2007	3:37:00 PM	JS	1	1	1	1	1	BHP2
Mis-D90-M	Dust	9/1/2007	5:48:00 PM	JS	1	1	1	1	1	BHP2

LS1507

Turn around Required: _____
Special Instructions (Billing details, QC reporting, etc): _____

Billing Code: BHP2503

Relinquished by:	Date Time	Received by:	Date Time
		HD	07/09/07 1302
Relinquished by:	Date Time	Received by:	Date Time

FOR LAB USE ONLY

Cooler seal intact upon receipt? ☒ Yes ☐ No ☐ N/A Sample temperature upon receipt: 13 c.
☐ Yes ☒ No ☐ Frozen? ☐ Yes ☒ No

Send Analytical Results to:

compliance.team@bhpbilliton.com



ALS Environmental
excellence in analytical testing

1988 Triumph Street, Vancouver, BC V5L 1K5
Tel: 604-253-4188 Toll Free: 1-800-665-0243 Fax: 604-253-6700
ALS Contact: Can Dang

Form 10881



BHP Billiton Diamonds Inc.
1102 4920 52nd Street, Yellowknife, NT X1A 3T1
Tel: 867-880-2157 Fax: 867-880-4012
BHP Contacts: Karen Hosford/Rob MacLean

CHAIN OF CUSTODY FORM

Station ID	Matrix	Date	Time	Init	Dustfall Metals	Insoluble Particulate	Nitrate	Soluble Particulate	Sulphate	Total Particulate
Fox-U30-P	Dust	9/1/2007	3:37:00 PM	JS	1	1	1	1	1	BHP2
Fox-D90-M	Dust	9/1/2007	3:37:00 PM	JS	1	1	1	1	1	BHP2
Fox-D30-P	Dust	9/1/2007	3:37:00 PM	JS	1	1	1	1	1	BHP2
Fox-D30-M	Dust	9/1/2007	3:37:00 PM	JS	1	1	1	1	1	BHP2
Fox-D300-P	Dust	9/1/2007	3:37:00 PM	JS	1	1	1	1	1	BHP2
Fox-D300-M	Dust	9/1/2007	3:37:00 PM	JS	1	1	1	1	1	BHP2
QA-54-P	Dust	9/1/2007	1:35:00 PM	JS	1	1	1	1	1	BHP2
QA-54-M	Dust	9/1/2007	1:35:00 PM	JS	1	1	1	1	1	BHP2

L551507

For Lab Use

Turn around Required: _____
Special Instructions (Billing details, QC reporting, etc): _____

Billing Code: BHP2503

Relinquished by:	Date Time	Received by:	Date Time
Relinquished by:	Date Time	Received by:	Date Time

FOR LAB USE ONLY

Cooler seal intact upon receipt?

☐ Yes

☒ No

☐ N/A

Sample temperature upon receipt:

Frozen? ☐ Yes

☒ No

Send Analytical Results to:

compliance.team@bhpbilliton.com



Environmental Division

ANALYTICAL REPORT

BHP BILLITON DIAMONDS INC.

ATTN: RICHARD EHLERT

1102 - 4920 52ND STREET

YELLOWKNIFE NT X1A 3T1

Reported On: 24-JUL-08 05:11 PM

Revision: 1

Lab Work Order #: L653887

Date Received: 09-JUL-08

Project P.O. #: BHP2503

Job Reference: 61649

Legal Site Desc: 6200503513

CofC Numbers: 61649

Other Information:

Comments:

Can Dang
Account Manager

THIS REPORT SHALL NOT BE REPRODUCED EXCEPT IN FULL WITHOUT THE WRITTEN AUTHORITY OF THE LABORATORY.
ALL SAMPLES WILL BE DISPOSED OF AFTER 30 DAYS FOLLOWING ANALYSIS. PLEASE CONTACT THE LAB IF YOU
REQUIRE ADDITIONAL SAMPLE STORAGE TIME.

ALS LABORATORY GROUP ANALYTICAL REPORT

Sample ID Description Sampled Date Sampled Time Client ID		L653887-1	L653887-2	L653887-3	L653887-4	L653887-5
		05-JUN-08 14:50 AQ-49-M	05-JUN-08 18:15 FOX-D90-M	05-JUN-08 18:15 FOX-D90-P	05-JUN-08 18:15 FOX-U30-M	05-JUN-08 16:45 MIS-D300-M
Grouping	Analyte					
DUSTFALL						
Particulates	Total Dustfall (mg/dm2.day)			3.67		
	Total Insoluble Dustfall (mg/dm2.day)			3.46		
	Total Soluble Dustfall (mg/dm2.day)			0.21		
Anions and Nutrients	Nitrate (as N) (mg/dm2.day)			0.00052		
	Sulfate (SO4) (mg/dm2.day)			0.0122		
Metals	Aluminum (Al)-Total (mg/dm2.day)	0.00036	0.0298		0.0632	0.000993
	Antimony (Sb)-Total (mg/dm2.day)	<0.000010	<0.0000010		<0.0000010	<0.0000010
	Arsenic (As)-Total (mg/dm2.day)	<0.000010	0.0000026		0.0000031	<0.0000010
	Barium (Ba)-Total (mg/dm2.day)	0.0000260	0.000558		0.00104	0.0000274
	Beryllium (Be)-Total (mg/dm2.day)	<0.000070	<0.0000070		<0.0000070	<0.0000070
	Bismuth (Bi)-Total (mg/dm2.day)	<0.000070	<0.0000070		<0.0000070	<0.0000070
	Boron (B)-Total (mg/dm2.day)	<0.0010	<0.00010		<0.00010	<0.00010
	Cadmium (Cd)-Total (mg/dm2.day)	<0.0000070	0.00000174		0.00000134	<0.00000070
	Calcium (Ca)-Total (mg/dm2.day)	<0.0030	0.0219		0.0264	0.00276
	Chromium (Cr)-Total (mg/dm2.day)	<0.000070	0.000104		0.000230	<0.0000070
	Cobalt (Co)-Total (mg/dm2.day)	<0.000010	0.0000254		0.0000478	<0.0000010
	Copper (Cu)-Total (mg/dm2.day)	0.000049	0.0000810		0.000101	0.0000430
	Lead (Pb)-Total (mg/dm2.day)	<0.0000070	0.00000553		0.00000888	0.00000134
	Lithium (Li)-Total (mg/dm2.day)	<0.00070	<0.000070		0.000118	<0.000070
	Magnesium (Mg)-Total (mg/dm2.day)	0.00311	0.0297		0.0602	0.00127
	Manganese (Mn)-Total (mg/dm2.day)	0.000105	0.000475		0.000828	0.0000309
	Mercury (Hg)-Total (mg/dm2.day)	<0.00000070	<0.00000070		<0.00000070	<0.00000070
	Molybdenum (Mo)-Total (mg/dm2.day)	<0.0000070	0.00000217		0.00000292	<0.00000070
	Nickel (Ni)-Total (mg/dm2.day)	<0.000070	0.000188		0.000269	0.0000084
	Potassium (K)-Total (mg/dm2.day)	0.0369	0.0287		0.0559	0.00134
	Selenium (Se)-Total (mg/dm2.day)	<0.00010	<0.000010		<0.000010	<0.000010
	Silver (Ag)-Total (mg/dm2.day)	<0.0000010	0.00000018		0.00000014	<0.00000010
	Sodium (Na)-Total (mg/dm2.day)	<0.0070	0.0110		0.0160	0.00117
	Strontium (Sr)-Total (mg/dm2.day)	<0.000010	0.000217		0.000286	0.0000098
	Thallium (Tl)-Total (mg/dm2.day)	<0.000010	<0.0000010		0.0000015	<0.0000010
	Tin (Sn)-Total (mg/dm2.day)	<0.000010	0.0000022		0.0000028	<0.0000010
	Uranium (U)-Total (mg/dm2.day)	<0.0000010	0.00000214		0.00000265	0.00000014
	Vanadium (V)-Total (mg/dm2.day)	<0.00010	0.000095		0.000206	<0.000010
	Zinc (Zn)-Total (mg/dm2.day)	0.00017	0.000263		0.000341	0.000058

ALS LABORATORY GROUP ANALYTICAL REPORT

Sample ID Description Sampled Date Sampled Time Client ID		L653887-6	L653887-7	L653887-8	L653887-9	L653887-10
		05-JUN-08 16:45 MIS-D300-P	05-JUN-08 16:45 MIS-D30-M	05-JUN-08 16:45 MIS-D30-P	05-JUN-08 16:45 MIS-D90-M	05-JUN-08 16:45 MIS-U30-M
Grouping	Analyte					
DUSTFALL						
Particulates	Total Dustfall (mg/dm2.day)	0.35		0.46		
	Total Insoluble Dustfall (mg/dm2.day)	0.23		0.38		
	Total Soluble Dustfall (mg/dm2.day)	0.12		<0.10		
Anions and Nutrients	Nitrate (as N) (mg/dm2.day)	0.00035		0.00067		
	Sulfate (SO4) (mg/dm2.day)	<0.0030		0.0037		
Metals	Aluminum (Al)-Total (mg/dm2.day)		0.00129		0.00133	0.00211
	Antimony (Sb)-Total (mg/dm2.day)		<0.0000010		<0.0000010	<0.0000010
	Arsenic (As)-Total (mg/dm2.day)		<0.0000010		<0.0000010	<0.0000010
	Barium (Ba)-Total (mg/dm2.day)		0.0000329		0.0000391	0.0000897
	Beryllium (Be)-Total (mg/dm2.day)		<0.0000070		<0.0000070	<0.0000070
	Bismuth (Bi)-Total (mg/dm2.day)		<0.0000070		<0.0000070	<0.0000070
	Boron (B)-Total (mg/dm2.day)		<0.00010		<0.00010	<0.00010
	Cadmium (Cd)-Total (mg/dm2.day)		<0.00000070		<0.00000070	<0.00000070
	Calcium (Ca)-Total (mg/dm2.day)		0.00298		0.00376	0.00272
	Chromium (Cr)-Total (mg/dm2.day)		<0.0000070		<0.0000070	<0.0000070
	Cobalt (Co)-Total (mg/dm2.day)		<0.0000010		<0.0000010	0.0000023
	Copper (Cu)-Total (mg/dm2.day)		0.0000454		0.0000348	0.0000161
	Lead (Pb)-Total (mg/dm2.day)		0.00000128		0.00000074	0.00000098
	Lithium (Li)-Total (mg/dm2.day)		<0.000070		<0.000070	<0.000070
	Magnesium (Mg)-Total (mg/dm2.day)		0.00175		0.00145	0.00250
	Manganese (Mn)-Total (mg/dm2.day)		0.0000299		0.0000349	0.0000690
	Mercury (Hg)-Total (mg/dm2.day)		<0.00000070		<0.00000070	<0.00000070
	Molybdenum (Mo)-Total (mg/dm2.day)		<0.00000070		<0.00000070	<0.00000070
	Nickel (Ni)-Total (mg/dm2.day)		0.0000089		0.0000088	0.0000142
	Potassium (K)-Total (mg/dm2.day)		0.00614		0.00182	0.00389
	Selenium (Se)-Total (mg/dm2.day)		<0.000010		<0.000010	<0.000010
	Silver (Ag)-Total (mg/dm2.day)		<0.00000010		<0.00000010	<0.00000010
	Sodium (Na)-Total (mg/dm2.day)		0.00175		0.00091	<0.00070
	Strontium (Sr)-Total (mg/dm2.day)		0.0000120		0.0000111	0.0000169
	Thallium (Tl)-Total (mg/dm2.day)		<0.0000010		<0.0000010	<0.0000010
	Tin (Sn)-Total (mg/dm2.day)		<0.0000010		<0.0000010	<0.0000010
	Uranium (U)-Total (mg/dm2.day)		0.00000033		0.00000017	0.00000045
	Vanadium (V)-Total (mg/dm2.day)		<0.000010		<0.000010	<0.000010
	Zinc (Zn)-Total (mg/dm2.day)		0.000045		0.000046	0.000037

ALS LABORATORY GROUP ANALYTICAL REPORT

		Sample ID	L653887-11	L653887-12	L653887-13	L653887-14	L653887-15
		Description					
		Sampled Date	05-JUN-08	05-JUN-08	05-JUN-08	05-JUN-08	05-JUN-08
		Sampled Time	16:45	18:15	12:50	12:50	12:00
		Client ID	MIS-U30-P	FOX-U30-P	FOX-D1000-P	FOX-D1000-M	MIS-D1000-P
Grouping	Analyte						
DUSTFALL							
Particulates	Total Dustfall (mg/dm2.day)		0.81	4.88	0.39		0.17
	Total Insoluble Dustfall (mg/dm2.day)		0.74	4.71	0.26		<0.10
	Total Soluble Dustfall (mg/dm2.day)		<0.10	0.17	0.13		0.11
Anions and Nutrients	Nitrate (as N) (mg/dm2.day)		0.00069	0.00072	0.00065		0.00049
	Sulfate (SO4) (mg/dm2.day)		0.0042	0.0079	<0.0030		<0.0030
Metals	Aluminum (Al)-Total (mg/dm2.day)					0.00296	
	Antimony (Sb)-Total (mg/dm2.day)					<0.0000010	
	Arsenic (As)-Total (mg/dm2.day)					<0.0000010	
	Barium (Ba)-Total (mg/dm2.day)					0.000102	
	Beryllium (Be)-Total (mg/dm2.day)					<0.0000070	
	Bismuth (Bi)-Total (mg/dm2.day)					<0.0000070	
	Boron (B)-Total (mg/dm2.day)					<0.00010	
	Cadmium (Cd)-Total (mg/dm2.day)					<0.00000070	
	Calcium (Ca)-Total (mg/dm2.day)					0.00308	
	Chromium (Cr)-Total (mg/dm2.day)					0.0000147	
	Cobalt (Co)-Total (mg/dm2.day)					0.0000035	
	Copper (Cu)-Total (mg/dm2.day)					0.000166	
	Lead (Pb)-Total (mg/dm2.day)					0.00000172	
	Lithium (Li)-Total (mg/dm2.day)					<0.000070	
	Magnesium (Mg)-Total (mg/dm2.day)					0.00348	
	Manganese (Mn)-Total (mg/dm2.day)					0.0000752	
	Mercury (Hg)-Total (mg/dm2.day)					<0.00000070	
	Molybdenum (Mo)-Total (mg/dm2.day)					0.00000071	
	Nickel (Ni)-Total (mg/dm2.day)					0.0000248	
	Potassium (K)-Total (mg/dm2.day)					0.00336	
	Selenium (Se)-Total (mg/dm2.day)					<0.000010	
	Silver (Ag)-Total (mg/dm2.day)					<0.00000010	
	Sodium (Na)-Total (mg/dm2.day)					0.00105	
	Strontium (Sr)-Total (mg/dm2.day)					0.0000226	
	Thallium (Tl)-Total (mg/dm2.day)					<0.0000010	
	Tin (Sn)-Total (mg/dm2.day)					<0.0000010	
	Uranium (U)-Total (mg/dm2.day)					0.00000024	
	Vanadium (V)-Total (mg/dm2.day)					<0.000010	
	Zinc (Zn)-Total (mg/dm2.day)					0.000088	

ALS LABORATORY GROUP ANALYTICAL REPORT

		Sample ID				
		Description				
		Sampled Date				
		Sampled Time				
		Client ID				
Grouping	Analyte					
DUSTFALL						
Particulates	Total Dustfall (mg/dm2.day)				0.46	11.3
	Total Insoluble Dustfall (mg/dm2.day)				0.28	7.07
	Total Soluble Dustfall (mg/dm2.day)				0.18	4.19
Anions and Nutrients	Nitrate (as N) (mg/dm2.day)				0.00035	<0.0006
	Sulfate (SO4) (mg/dm2.day)				0.0143	<0.060
Metals	Aluminum (Al)-Total (mg/dm2.day)	0.000469	0.00167	0.00229		
	Antimony (Sb)-Total (mg/dm2.day)	<0.000010	<0.000010	<0.000010		
	Arsenic (As)-Total (mg/dm2.day)	<0.000010	<0.000010	<0.000010		
	Barium (Ba)-Total (mg/dm2.day)	0.0000133	0.0000512	0.0000851		
	Beryllium (Be)-Total (mg/dm2.day)	<0.000070	<0.000070	<0.000070		
	Bismuth (Bi)-Total (mg/dm2.day)	<0.000070	<0.000070	<0.000070		
	Boron (B)-Total (mg/dm2.day)	<0.00010	<0.00010	<0.00010		
	Cadmium (Cd)-Total (mg/dm2.day)	<0.0000070	<0.0000070	<0.0000070		
	Calcium (Ca)-Total (mg/dm2.day)	0.00174	0.00233	0.00364		
	Chromium (Cr)-Total (mg/dm2.day)	<0.000070	0.0000090	0.0000155		
	Cobalt (Co)-Total (mg/dm2.day)	<0.000010	0.0000022	0.0000037		
	Copper (Cu)-Total (mg/dm2.day)	0.0000849	0.0000295	0.000235		
	Lead (Pb)-Total (mg/dm2.day)	0.00000137	0.00000103	0.00000126		
	Lithium (Li)-Total (mg/dm2.day)	<0.000070	<0.000070	<0.000070		
	Magnesium (Mg)-Total (mg/dm2.day)	0.000980	0.00239	0.00477		
	Manganese (Mn)-Total (mg/dm2.day)	0.0000179	0.0000456	0.0000791		
	Mercury (Hg)-Total (mg/dm2.day)	<0.0000070	<0.0000070	<0.0000070		
	Molybdenum (Mo)-Total (mg/dm2.day)	<0.0000070	0.00000143	0.00000165		
	Nickel (Ni)-Total (mg/dm2.day)	<0.000070	0.0000212	0.0000403		
	Potassium (K)-Total (mg/dm2.day)	0.00322	0.00145	0.00275		
	Selenium (Se)-Total (mg/dm2.day)	<0.000010	<0.000010	<0.000010		
	Silver (Ag)-Total (mg/dm2.day)	0.00000016	0.00000020	<0.00000010		
	Sodium (Na)-Total (mg/dm2.day)	0.00152	0.00083	0.00510		
	Strontium (Sr)-Total (mg/dm2.day)	0.0000074	0.0000212	0.0000484		
	Thallium (Tl)-Total (mg/dm2.day)	<0.000010	<0.000010	<0.000010		
	Tin (Sn)-Total (mg/dm2.day)	<0.000010	<0.000010	<0.000010		
	Uranium (U)-Total (mg/dm2.day)	0.00000020	0.00000022	0.00000020		
	Vanadium (V)-Total (mg/dm2.day)	<0.000010	<0.000010	<0.000010		
	Zinc (Zn)-Total (mg/dm2.day)	0.000049	0.000050	0.000067		

ALS LABORATORY GROUP ANALYTICAL REPORT

Sample ID Description Sampled Date Sampled Time Client ID		L653887-21	L653887-22	L653887-23	L653887-24	L653887-25
Grouping Analyte						
DUSTFALL						
Particulates	Total Dustfall (mg/dm2.day)		0.33		1.54	
	Total Insoluble Dustfall (mg/dm2.day)		<0.10		1.39	
	Total Soluble Dustfall (mg/dm2.day)		0.23		0.15	
Anions and Nutrients	Nitrate (as N) (mg/dm2.day)		0.00056		0.00092	
	Sulfate (SO4) (mg/dm2.day)		0.0065		0.0056	
Metals	Aluminum (Al)-Total (mg/dm2.day)	0.000214		0.0134		0.0894
	Antimony (Sb)-Total (mg/dm2.day)	<0.0000010		<0.0000010		<0.0000010
	Arsenic (As)-Total (mg/dm2.day)	<0.0000010		<0.0000010		0.0000047
	Barium (Ba)-Total (mg/dm2.day)	0.00000721		0.000268		0.00149
	Beryllium (Be)-Total (mg/dm2.day)	<0.0000070		<0.0000070		<0.0000070
	Bismuth (Bi)-Total (mg/dm2.day)	<0.0000070		<0.0000070		<0.0000070
	Boron (B)-Total (mg/dm2.day)	<0.00010		<0.00010		<0.00010
	Cadmium (Cd)-Total (mg/dm2.day)	<0.00000070		<0.00000070		<0.00000070
	Calcium (Ca)-Total (mg/dm2.day)	0.00115		0.00641		0.0424
	Chromium (Cr)-Total (mg/dm2.day)	<0.0000070		0.0000541		0.000319
	Cobalt (Co)-Total (mg/dm2.day)	<0.0000010		0.0000107		0.0000676
	Copper (Cu)-Total (mg/dm2.day)	0.0000340		0.0000362		0.000106
	Lead (Pb)-Total (mg/dm2.day)	0.00000208		0.00000233		0.0000129
	Lithium (Li)-Total (mg/dm2.day)	<0.000070		<0.000070		0.000145
	Magnesium (Mg)-Total (mg/dm2.day)	0.000342		0.0137		0.0847
	Manganese (Mn)-Total (mg/dm2.day)	0.0000146		0.000223		0.00116
	Mercury (Hg)-Total (mg/dm2.day)	<0.00000070		<0.00000070		<0.00000070
	Molybdenum (Mo)-Total (mg/dm2.day)	<0.00000070		0.00000090		0.00000511
	Nickel (Ni)-Total (mg/dm2.day)	<0.0000070		0.0000691		0.000409
	Potassium (K)-Total (mg/dm2.day)	0.00087		0.0167		0.0620
	Selenium (Se)-Total (mg/dm2.day)	<0.000010		<0.000010		<0.000010
	Silver (Ag)-Total (mg/dm2.day)	<0.00000010		<0.00000010		0.00000029
	Sodium (Na)-Total (mg/dm2.day)	0.00071		0.00457		0.0180
	Strontium (Sr)-Total (mg/dm2.day)	0.0000041		0.0000786		0.000527
	Thallium (Tl)-Total (mg/dm2.day)	<0.0000010		<0.0000010		0.0000018
	Tin (Sn)-Total (mg/dm2.day)	<0.0000010		<0.0000010		0.0000024
	Uranium (U)-Total (mg/dm2.day)	<0.00000010		0.00000076		0.00000494
	Vanadium (V)-Total (mg/dm2.day)	<0.000010		0.000046		0.000279
	Zinc (Zn)-Total (mg/dm2.day)	0.000037		0.000098		0.000329

ALS LABORATORY GROUP ANALYTICAL REPORT

Sample ID Description Sampled Date Sampled Time Client ID		L653887-26	L653887-27	L653887-28	L653887-29	L653887-30
Grouping Analyte						
DUSTFALL						
Particulates	Total Dustfall (mg/dm2.day)	20.2	0.25		<0.10	
	Total Insoluble Dustfall (mg/dm2.day)	19.8	0.16		<0.10	
	Total Soluble Dustfall (mg/dm2.day)	0.37	<0.10		<0.10	
Anions and Nutrients	Nitrate (as N) (mg/dm2.day)	0.00016	<0.00003		0.00061	
	Sulfate (SO4) (mg/dm2.day)	0.0283	<0.0030		0.0034	
Metals	Aluminum (Al)-Total (mg/dm2.day)			0.000720		0.0211
	Antimony (Sb)-Total (mg/dm2.day)			<0.0000010		<0.0000010
	Arsenic (As)-Total (mg/dm2.day)			<0.0000010		0.0000018
	Barium (Ba)-Total (mg/dm2.day)			0.0000302		0.000546
	Beryllium (Be)-Total (mg/dm2.day)			<0.0000070		<0.0000070
	Bismuth (Bi)-Total (mg/dm2.day)			<0.0000070		<0.0000070
	Boron (B)-Total (mg/dm2.day)			<0.00010		<0.00010
	Cadmium (Cd)-Total (mg/dm2.day)			<0.00000070		<0.00000070
	Calcium (Ca)-Total (mg/dm2.day)			0.00449		0.0101
	Chromium (Cr)-Total (mg/dm2.day)			<0.0000070		0.000107
	Cobalt (Co)-Total (mg/dm2.day)			<0.0000010		0.0000210
	Copper (Cu)-Total (mg/dm2.day)			0.0000390		0.000119
	Lead (Pb)-Total (mg/dm2.day)			0.00000074		0.00000770
	Lithium (Li)-Total (mg/dm2.day)			<0.000070		<0.000070
	Magnesium (Mg)-Total (mg/dm2.day)			0.00183		0.0241
	Manganese (Mn)-Total (mg/dm2.day)			0.0000153		0.000430
	Mercury (Hg)-Total (mg/dm2.day)			<0.00000070		<0.00000070
	Molybdenum (Mo)-Total (mg/dm2.day)			<0.00000070		0.00000182
	Nickel (Ni)-Total (mg/dm2.day)			0.0000185		0.000117
	Potassium (K)-Total (mg/dm2.day)			0.00151		0.0214
	Selenium (Se)-Total (mg/dm2.day)			<0.000010		<0.000010
	Silver (Ag)-Total (mg/dm2.day)			<0.00000010		0.00000024
	Sodium (Na)-Total (mg/dm2.day)			0.00090		0.00283
	Strontium (Sr)-Total (mg/dm2.day)			0.0000263		0.0000916
	Thallium (Tl)-Total (mg/dm2.day)			<0.0000010		<0.0000010
	Tin (Sn)-Total (mg/dm2.day)			<0.0000010		0.0000040
	Uranium (U)-Total (mg/dm2.day)			<0.00000010		0.00000249
	Vanadium (V)-Total (mg/dm2.day)			<0.000010		0.000092
	Zinc (Zn)-Total (mg/dm2.day)			<0.000010		0.000240

ALS LABORATORY GROUP ANALYTICAL REPORT

		Sample ID				
		Description				
		Sampled Date				
		Sampled Time				
		Client ID				
Grouping	Analyte					
DUSTFALL						
Particulates	Total Dustfall (mg/dm2.day)	<0.10	0.80		0.19	
	Total Insoluble Dustfall (mg/dm2.day)	<0.10	0.67		0.11	
	Total Soluble Dustfall (mg/dm2.day)	<0.10	0.13		<0.10	
Anions and Nutrients	Nitrate (as N) (mg/dm2.day)	0.00133	0.00117		0.00018	
	Sulfate (SO4) (mg/dm2.day)	0.0105	<0.0070		<0.0040	
Metals	Aluminum (Al)-Total (mg/dm2.day)			0.00493		
	Antimony (Sb)-Total (mg/dm2.day)			<0.0000010		
	Arsenic (As)-Total (mg/dm2.day)			<0.0000010		
	Barium (Ba)-Total (mg/dm2.day)			0.000162		
	Beryllium (Be)-Total (mg/dm2.day)			<0.0000070		
	Bismuth (Bi)-Total (mg/dm2.day)			<0.0000070		
	Boron (B)-Total (mg/dm2.day)			<0.00010		
	Cadmium (Cd)-Total (mg/dm2.day)			<0.00000070		
	Calcium (Ca)-Total (mg/dm2.day)			0.00542		
	Chromium (Cr)-Total (mg/dm2.day)			0.0000363		
	Cobalt (Co)-Total (mg/dm2.day)			0.0000075		
	Copper (Cu)-Total (mg/dm2.day)			0.0000350		
	Lead (Pb)-Total (mg/dm2.day)			0.00000185		
	Lithium (Li)-Total (mg/dm2.day)			<0.000070		
	Magnesium (Mg)-Total (mg/dm2.day)			0.0121		
	Manganese (Mn)-Total (mg/dm2.day)			0.000123		
	Mercury (Hg)-Total (mg/dm2.day)			<0.00000070		
	Molybdenum (Mo)-Total (mg/dm2.day)			0.00000143		
	Nickel (Ni)-Total (mg/dm2.day)			0.0000973		
	Potassium (K)-Total (mg/dm2.day)			0.00777		
	Selenium (Se)-Total (mg/dm2.day)			<0.000010		
	Silver (Ag)-Total (mg/dm2.day)			0.00000018		
	Sodium (Na)-Total (mg/dm2.day)			0.00234		
	Strontium (Sr)-Total (mg/dm2.day)			0.0000685		
	Thallium (Tl)-Total (mg/dm2.day)			<0.0000010		
	Tin (Sn)-Total (mg/dm2.day)			<0.0000010		
	Uranium (U)-Total (mg/dm2.day)			0.00000034		
	Vanadium (V)-Total (mg/dm2.day)			0.000017		
	Zinc (Zn)-Total (mg/dm2.day)			0.000058		

Reference Information

Qualifiers for Sample Submission Listed:

Qualifier	Description
NR:NR	No Result: Sample Not Received At Laboratory - Sampels # MIS D90-P not received
SR:COC	Sample Received, Not Listed on Submitted Chain of Custody / Analytical Request Form - Two samples with no ID's are extra

Methods Listed (if applicable):

ALS Test Code	Matrix	Test Description	Analytical Method Reference(Based On)
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ANIONS-DUSTNO3-IC-VA Dustfall Dustfall nitrate by Ion Chromatography APHA 4110 "Determination of Anions by IC

Dustfall analysis is carried out in accordance with procedures published by the B.C. Ministry of Environment Laboratory.

The nitrate analysis is carried out using procedures adapted from APHA Method 4110 "Determination of Anions by Ion Chromatography" and EPA Method 300.0 "Determination of Inorganic Anions by Ion Chromatography".

ANIONS-DUSTSO4-IC-VA Dustfall Dustfall sulphate by Ion Chromatography APHA 4110 "Determination of Anions by IC

Dustfall analysis is carried out in accordance with procedures published by the B.C. Ministry of Environment Laboratory.

The sulphate analysis is carried out using procedures adapted from APHA Method 4110 "Determination of Anions by Ion Chromatography" and EPA Method 300.0 "Determination of Inorganic Anions by Ion Chromatography".

DUSTFALLS-COM-DM2-VA Dustfall Combined dustfalls-Total, soluble, insol BCMOE "DUSTFALLS"

Dustfall analysis is carried out in accordance with procedures published by the B.C. Ministry of Environment Laboratory.

HG-DUST(DM2-CVAFS-VA Dustfall Total Mercury in Dustfalls by CVAFS EPA 245.7

This analysis is carried out using procedures adapted from "Standard Methods for the Examination of Water and Wastewater" published by the American Public Health Association, and with procedures adapted from "Test Methods for Evaluating Solid Waste" SW-846 published by the United States Environmental Protection Agency (EPA). Instrumental analysis is by cold vapour atomic fluorescence spectrophotometry (EPA Method 245.7).

MET-DUST(DM2)-MS-VA Dustfall Total Metals in Dustfalls by ICPMS EPA 6020A

This analysis is carried out using procedures adapted from "Standard Methods for the Examination of Water and Wastewater" published by the American Public Health Association, and with procedures adapted from "Test Methods for Evaluating Solid Waste" SW-846 published by the United States Environmental Protection Agency (EPA). Instrumental analysis is by inductively coupled plasma - mass spectrometry (EPA Method 6020A).

** Laboratory Methods employed follow in-house procedures, which are generally based on nationally or internationally accepted methodologies.

The last two letters of the above ALS Test Code column indicate the laboratory that performed analytical analysis for that test. Refer to the list below:

Laboratory Definition Code	Laboratory Location	Laboratory Definition Code	Laboratory Location
VA	ALS LABORATORY GROUP - VANCOUVER, BC, CANADA		

Reference Information

Methods Listed (if applicable):

ALS Test Code	Matrix	Test Description	Analytical Method Reference(Based On)
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GLOSSARY OF REPORT TERMS

Surr - A surrogate is an organic compound that is similar to the target analyte(s) in chemical composition and behavior but not normally detected in environmental samples. Prior to sample processing, samples are fortified with one or more surrogate compounds.

The reported surrogate recovery value provides a measure of method efficiency.

mg/kg (units) - unit of concentration based on mass, parts per million

mg/L (units) - unit of concentration based on volume, parts per million

N/A - Result not available. Refer to qualifier code and definition for explanation

Test results reported relate only to the samples as received by the laboratory.

UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.

Although test results are generated under strict QA/QC protocols, any unsigned test reports, faxes, or emails are considered preliminary.

ALS Laboratory Group has an extensive QA/QC program where all analytical data reported is analyzed using approved referenced procedures followed by checks and reviews by senior managers and quality assurance personnel. However, since the results are obtained from chemical measurements and thus cannot be guaranteed, ALS Laboratory Group assumes no liability for the use or interpretation of the results.



ALS Environmental
excellence in analytical testing

1988 Triumph Street, Vancouver, BC V5L 1K5
Tel: 604-253-4188 Toll Free: 1-800-665-0243 Fax: 604-253-6700
ALS Contact: Can Dang

Form 61649



bhpbilliton
BHP Billiton Diamonds Inc.
1102 4920 52nd Street, Yellowknife, NT X1A 3T1
Tel: 867-880-2157 Fax: 867-880-4012
BHP Contacts: David Bruce/ Richard Ehler

CHAIN OF CUSTODY FORM

Station ID	Matrix	Date	Time	Init	Dustfall Metals	Insoluble Particulate	Nitrate	Soluble Particulate	Sulphate	Total Particulate
AQ-49-M	Dust	6/5/2008	2:50:00 PM SH	1	1	1	1	1	1	BHP2
Fox-D90-M	Dust	6/5/2008	6:15:00 PM SH	1	1	1	1	1	1	BHP2
Fox-D90-P	Dust	6/5/2008	6:15:00 PM SH	1	1	1	1	1	1	BHP2
Fox-U30-M	Dust	6/5/2008	6:15:00 PM SH	1	1	1	1	1	1	BHP2
Mis-D300-M	Dust	6/5/2008	4:45:00 PM SH	1	1	1	1	1	1	BHP2
Mis-D300-P	Dust	6/5/2008	4:45:00 PM SH	1	1	1	1	1	1	BHP2
Mis-D30-M	Dust	6/5/2008	4:45:00 PM SH	1	1	1	1	1	1	BHP2
Mis-D30-P	Dust	6/5/2008	4:45:00 PM SH	1	1	1	1	1	1	BHP2
Mis-D90-M	Dust	6/5/2008	4:45:00 PM SH	1	1	1	1	1	1	BHP2
Mis-D90-P	Dust	6/5/2008	4:45:00 PM SH	1	1	1	1	1	1	BHP2
Mis-U30-M	Dust	6/5/2008	4:45:00 PM SH	1	1	1	1	1	1	BHP2
Mis-U30-P	Dust	6/5/2008	4:45:00 PM SH	1	1	1	1	1	1	BHP2
Fox-U30-P	Dust	6/5/2008	6:15:00 PM SH	1	1	1	1	1	1	BHP2
FOX-D1000-P	Dust	6/5/2008	12:50:00 P SH	1	1	1	1	1	1	BHP2
FOX-D1000-M	Dust	6/5/2008	12:50:00 P SH	1	1	1	1	1	1	BHP2
MIS-D1000-P	Dust	6/5/2008	12:00:00 P SH	1	1	1	1	1	1	BHP2
MIS-D1000-M	Dust	6/5/2008	12:00:00 P SH	1	1	1	1	1	1	BHP2
Air-P125-M	Dust	6/5/2008	5:15:00 PM SH	1	1	1	1	1	1	BHP2
LLCF-PA-M	Dust	6/6/2008	4:15:00 PM SH	1	1	1	1	1	1	BHP2
LLCF-PA-P	Dust	6/6/2008	4:15:00 PM SH	1	1	1	1	1	1	BHP2

Turn around Required: Regular

Special Instructions (Billing details, QC reporting, etc):

Billing Code: BHP2503

5 coolers!

Relinquished by:	Date: 0905 Time: 2:50:00	Received by:	Date: 8/7/08 Time: 1:00
Relinquished by:	Date:	Received by:	Date:

FOR LAB USE ONLY

<input checked="" type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> N/A	<input type="checkbox"/> Frozen?	<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No
Cooler seal intact upon receipt?					
Sample temperature upon receipt: 25 c					

Send Analytical Results to:

compliance.team@bhpbilliton.com;



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1988 Triumph Street, Vancouver, BC V5L 1K5

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Tel: 867-880-2157 Fax: 867-880-4012

BHP Contacts: David Bruce/ Richard Ehler/David

CHAIN OF CUSTODY FORM

Station ID	Matrix	Date	Time	Init	Dustfall Metals	Insoluble Particulate	Nitrate	Soluble Particulate	Sulphate	Total Particulate
AQ-49-P	Dust	6/5/2008	2:50:00 PM	SH	1	1	1	1	1	BHP2
AQ-54-M	Dust	6/5/2008	3:05:00 PM	SH	1	1	1	1	1	BHP2
AQ-54-P	Dust	6/5/2008	3:05:00 PM	SH	1	1	1	1	1	BHP2
Fox-D300-M	Dust	6/5/2008	6:15:00 PM	SH	1	1	1	1	1	BHP2
Fox-D300-P	Dust	6/5/2008	6:15:00 PM	SH	1	1	1	1	1	BHP2
Fox-D30-M	Dust	6/5/2008	6:15:00 PM	SH	1	1	1	1	1	BHP2
Fox-D30-P	Dust	6/5/2008	6:15:00 PM	SH	1	1	1	1	1	BHP2
Air-P125-P	Dust	6/5/2008	5:15:00 PM	SH	1	1	1	1	1	BHP2
Air-P162-M	Dust	6/5/2008	5:30:00 PM	SH	1	1	1	1	1	BHP2
Air-P162-P	Dust	6/5/2008	5:30:00 PM	SH	1	1	1	1	1	BHP2
Air-P280-M	Dust	6/5/2008	5:52:00 PM	SH	1	1	1	1	1	BHP2
Air-P280-P	Dust	6/5/2008	5:52:00 PM	SH	1	1	1	1	1	BHP2
LLCF-PB-P	Dust	6/6/2008	4:30:00 PM	SH	1	1	1	1	1	BHP2
LLCF-PB-M	Dust	6/6/2008	4:30:00 PM	SH	1	1	1	1	1	BHP2

For Lab Use

FOR LAB USE ONLY

Turn around Required: Regular	Relinquished by: [Signature]	Date: 8/7/9	Time: 10:00
Special Instructions (Billing details, QC reporting, etc):	Relinquished by: [Signature]	Date: 8/7/9	Time: 10:00
Billing Code: BHP2503	FOR LAB USE ONLY		
Cooler seal intact upon receipt? <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No		Sample temperature upon receipt: 25c	
Frozen? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No		Send Analytical Results to:	

compliance.team@bhpbilliton.com;



Environmental Division

Certificate of Analysis

BHP BILLITON DIAMONDS INC.

ATTN: RICHARD EHLERT

1102 - 4920 52ND STREET

YELLOWKNIFE NT X1A 3T1

Reported On: 05-SEP-08 06:53 PM

Lab Work Order #: L667852

Date Received: 12-AUG-08

Project P.O. #: BHP2503

Job Reference: 61693

Legal Site Desc: 6200503513

CofC Numbers: 61693

Other Information:

Comments:

Can Dang
Account Manager

THIS REPORT SHALL NOT BE REPRODUCED EXCEPT IN FULL WITHOUT THE WRITTEN AUTHORITY OF THE LABORATORY.
ALL SAMPLES WILL BE DISPOSED OF AFTER 30 DAYS FOLLOWING ANALYSIS. PLEASE CONTACT THE LAB IF YOU
REQUIRE ADDITIONAL SAMPLE STORAGE TIME.

ALS LABORATORY GROUP ANALYTICAL REPORT

Sample ID Description Sampled Date Sampled Time Client ID		L667852-1	L667852-2	L667852-3	L667852-4	L667852-5
Grouping Analyte						
DUSTFALL						
Particulates	Total Dustfall (mg/dm2.day)			2.87		
	Total Insoluble Dustfall (mg/dm2.day)			2.86		
	Total Soluble Dustfall (mg/dm2.day)			<0.10		
Anions and Nutrients	Nitrate (as N) (mg/dm2.day)			0.00114		
	Sulfate (SO4) (mg/dm2.day)			0.0074		
Metals	Aluminum (Al)-Total (mg/dm2.day)	0.000375	0.0714		0.0850	0.000849
	Antimony (Sb)-Total (mg/dm2.day)	<0.0000010	<0.0000010		<0.0000010	<0.0000010
	Arsenic (As)-Total (mg/dm2.day)	<0.0000010	0.0000033		0.0000040	<0.0000010
	Barium (Ba)-Total (mg/dm2.day)	0.0000123	0.00107		0.00132	0.0000184
	Beryllium (Be)-Total (mg/dm2.day)	<0.0000060	<0.0000060		<0.0000060	<0.0000060
	Bismuth (Bi)-Total (mg/dm2.day)	<0.0000060	<0.0000060		<0.0000060	<0.0000060
	Boron (B)-Total (mg/dm2.day)	<0.00010	<0.00010		<0.00010	<0.00010
	Cadmium (Cd)-Total (mg/dm2.day)	<0.00000060	0.00000084		0.00000117	<0.00000060
	Calcium (Ca)-Total (mg/dm2.day)	0.00289	0.0345		0.0358	0.00599
	Chromium (Cr)-Total (mg/dm2.day)	<0.0000060	0.000231		0.000281	<0.0000060
	Cobalt (Co)-Total (mg/dm2.day)	<0.0000010	0.0000510		0.0000619	<0.0000010
	Copper (Cu)-Total (mg/dm2.day)	0.00232	0.00188		0.00129	0.0000985
	Lead (Pb)-Total (mg/dm2.day)	0.00000094	0.00000966		0.0000124	0.00000153
	Lithium (Li)-Total (mg/dm2.day)	<0.000060	0.000116		0.000141	<0.000060
	Magnesium (Mg)-Total (mg/dm2.day)	0.000593	0.0718		0.0896	0.00145
	Manganese (Mn)-Total (mg/dm2.day)	0.0000696	0.000975		0.00117	0.0000772
	Mercury (Hg)-Total (mg/dm2.day)	<0.00000060	<0.00000060		<0.00000060	<0.00000060
	Molybdenum (Mo)-Total (mg/dm2.day)	<0.00000060	0.00000330		0.00000401	<0.00000060
	Nickel (Ni)-Total (mg/dm2.day)	<0.0000060	0.000340		0.000443	0.0000080
	Potassium (K)-Total (mg/dm2.day)	0.00064	0.0534		0.0740	0.00176
	Selenium (Se)-Total (mg/dm2.day)	<0.000010	<0.000010		<0.000010	<0.000010
	Silver (Ag)-Total (mg/dm2.day)	<0.00000010	0.00000026		0.00000038	<0.00000010
	Sodium (Na)-Total (mg/dm2.day)	<0.00060	0.0137		0.0205	0.00081
	Strontium (Sr)-Total (mg/dm2.day)	0.0000101	0.000338		0.000392	0.0000147
	Thallium (Tl)-Total (mg/dm2.day)	<0.0000010	0.0000014		0.0000018	<0.0000010
	Tin (Sn)-Total (mg/dm2.day)	<0.0000010	0.0000024		0.0000033	0.0000067
	Uranium (U)-Total (mg/dm2.day)	<0.00000010	0.00000325		0.00000388	0.00000032
	Vanadium (V)-Total (mg/dm2.day)	<0.000010	0.000197		0.000234	<0.000010
	Zinc (Zn)-Total (mg/dm2.day)	0.000049	0.00134		0.000807	0.000503

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS LABORATORY GROUP ANALYTICAL REPORT

Sample ID Description Sampled Date Sampled Time Client ID		L667852-6	L667852-7	L667852-8	L667852-9	L667852-10
		05-JUL-08 10:45 MIS-D300-P	05-JUL-08 10:20 MIS-D30-M	05-JUL-08 10:20 MIS-D30-P	05-JUL-08 10:35 MIS-D90-M	05-JUL-08 10:35 MIS-D90-P
Grouping	Analyte					
DUSTFALL						
Particulates	Total Dustfall (mg/dm2.day)	<0.10		0.39		0.37
	Total Insoluble Dustfall (mg/dm2.day)	<0.10		0.37		0.30
	Total Soluble Dustfall (mg/dm2.day)	<0.10		<0.10		<0.10
Anions and Nutrients	Nitrate (as N) (mg/dm2.day)	0.000305		0.000655		0.000070
	Sulfate (SO4) (mg/dm2.day)	<0.0020		<0.0040		0.0058
Metals	Aluminum (Al)-Total (mg/dm2.day)		0.00374		0.00115	
	Antimony (Sb)-Total (mg/dm2.day)		<0.0000010		<0.0000010	
	Arsenic (As)-Total (mg/dm2.day)		<0.0000010		<0.0000010	
	Barium (Ba)-Total (mg/dm2.day)		0.0000711		0.0000239	
	Beryllium (Be)-Total (mg/dm2.day)		<0.0000060		<0.0000060	
	Bismuth (Bi)-Total (mg/dm2.day)		<0.0000060		<0.0000060	
	Boron (B)-Total (mg/dm2.day)		<0.00010		<0.00010	
	Cadmium (Cd)-Total (mg/dm2.day)		<0.00000060		<0.00000060	
	Calcium (Ca)-Total (mg/dm2.day)		0.00377		0.00192	
	Chromium (Cr)-Total (mg/dm2.day)		0.0000148		<0.0000060	
	Cobalt (Co)-Total (mg/dm2.day)		0.0000028		<0.0000010	
	Copper (Cu)-Total (mg/dm2.day)		0.00169		0.00163	
	Lead (Pb)-Total (mg/dm2.day)		0.00000120		0.00000143	
	Lithium (Li)-Total (mg/dm2.day)		<0.000060		<0.000060	
	Magnesium (Mg)-Total (mg/dm2.day)		0.00391		0.00178	
	Manganese (Mn)-Total (mg/dm2.day)		0.000111		0.0000484	
	Mercury (Hg)-Total (mg/dm2.day)		<0.00000060		<0.00000060	
	Molybdenum (Mo)-Total (mg/dm2.day)		<0.00000060		<0.00000060	
	Nickel (Ni)-Total (mg/dm2.day)		0.0000179		0.0000081	
	Potassium (K)-Total (mg/dm2.day)		0.00579		0.00795	
	Selenium (Se)-Total (mg/dm2.day)		<0.000010		<0.000010	
	Silver (Ag)-Total (mg/dm2.day)		<0.00000010		<0.00000010	
	Sodium (Na)-Total (mg/dm2.day)		0.00081		0.00236	
	Strontium (Sr)-Total (mg/dm2.day)		0.0000195		0.0000100	
	Thallium (Tl)-Total (mg/dm2.day)		<0.0000010		<0.0000010	
	Tin (Sn)-Total (mg/dm2.day)		0.0000015		<0.0000010	
	Uranium (U)-Total (mg/dm2.day)		0.00000035		0.00000020	
	Vanadium (V)-Total (mg/dm2.day)		<0.000010		<0.000010	
	Zinc (Zn)-Total (mg/dm2.day)		0.000185		0.000085	

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS LABORATORY GROUP ANALYTICAL REPORT

Sample ID Description Sampled Date Sampled Time Client ID		L667852-11	L667852-12	L667852-13	L667852-14	L667852-15
		05-JUL-08 10:15 MIS-U30-M	05-JUL-08 10:15 MIS-U30-P	05-JUL-08 13:40 FOX-U30-P	05-JUL-08 15:45 FOX-D1000-P	05-JUL-08 15:45 FOX-D1000-M
Grouping	Analyte					
DUSTFALL						
Particulates	Total Dustfall (mg/dm2.day)		1.03	0.66	8.52	
	Total Insoluble Dustfall (mg/dm2.day)		0.44	0.58	8.32	
	Total Soluble Dustfall (mg/dm2.day)		0.58	<0.10	0.20	
Anions and Nutrients	Nitrate (as N) (mg/dm2.day)		0.000693	0.000295	0.000849	
	Sulfate (SO4) (mg/dm2.day)		<0.0040	0.0169	<0.0050	
Metals	Aluminum (Al)-Total (mg/dm2.day)	0.00914				0.00317
	Antimony (Sb)-Total (mg/dm2.day)	<0.0000010				<0.0000010
	Arsenic (As)-Total (mg/dm2.day)	<0.0000010				<0.0000010
	Barium (Ba)-Total (mg/dm2.day)	0.000179				0.0000644
	Beryllium (Be)-Total (mg/dm2.day)	<0.0000060				<0.0000060
	Bismuth (Bi)-Total (mg/dm2.day)	<0.0000060				<0.0000060
	Boron (B)-Total (mg/dm2.day)	<0.00010				<0.00010
	Cadmium (Cd)-Total (mg/dm2.day)	<0.00000060				<0.00000060
	Calcium (Ca)-Total (mg/dm2.day)	0.00521				0.00331
	Chromium (Cr)-Total (mg/dm2.day)	0.0000338				0.0000145
	Cobalt (Co)-Total (mg/dm2.day)	0.0000066				0.0000027
	Copper (Cu)-Total (mg/dm2.day)	0.00185				0.00192
	Lead (Pb)-Total (mg/dm2.day)	0.00000341				0.00000259
	Lithium (Li)-Total (mg/dm2.day)	<0.000060				<0.000060
	Magnesium (Mg)-Total (mg/dm2.day)	0.00820				0.00384
	Manganese (Mn)-Total (mg/dm2.day)	0.000208				0.000106
	Mercury (Hg)-Total (mg/dm2.day)	<0.00000060				<0.00000060
	Molybdenum (Mo)-Total (mg/dm2.day)	<0.00000060				<0.00000060
	Nickel (Ni)-Total (mg/dm2.day)	0.0000314				0.0000218
	Potassium (K)-Total (mg/dm2.day)	0.00786				0.00438
	Selenium (Se)-Total (mg/dm2.day)	<0.000010				<0.000010
	Silver (Ag)-Total (mg/dm2.day)	0.00000015				<0.00000010
	Sodium (Na)-Total (mg/dm2.day)	0.00153				0.00138
	Strontium (Sr)-Total (mg/dm2.day)	0.0000380				0.0000259
	Thallium (Tl)-Total (mg/dm2.day)	<0.0000010				<0.0000010
	Tin (Sn)-Total (mg/dm2.day)	0.0000015				<0.0000010
	Uranium (U)-Total (mg/dm2.day)	0.00000096				0.00000021
	Vanadium (V)-Total (mg/dm2.day)	0.000029				<0.000010
	Zinc (Zn)-Total (mg/dm2.day)	0.000079				0.000098

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS LABORATORY GROUP ANALYTICAL REPORT

		Sample ID				
		Description				
		Sampled Date				
		Sampled Time				
		Client ID				
Grouping	Analyte					
DUSTFALL						
Particulates	Total Dustfall (mg/dm2.day)	<0.10			0.29	1.61
	Total Insoluble Dustfall (mg/dm2.day)	<0.10			0.22	1.48
	Total Soluble Dustfall (mg/dm2.day)	<0.10			<0.10	0.13
Anions and Nutrients	Nitrate (as N) (mg/dm2.day)	0.000494			0.000759	0.00135
	Sulfate (SO4) (mg/dm2.day)	<0.0040			<0.0040	0.0085
Metals	Aluminum (Al)-Total (mg/dm2.day)		0.000941	0.00268		
	Antimony (Sb)-Total (mg/dm2.day)		<0.000010	<0.000010		
	Arsenic (As)-Total (mg/dm2.day)		<0.000010	<0.000010		
	Barium (Ba)-Total (mg/dm2.day)		0.0000193	0.0000600		
	Beryllium (Be)-Total (mg/dm2.day)		<0.0000060	<0.0000060		
	Bismuth (Bi)-Total (mg/dm2.day)		<0.0000060	<0.0000060		
	Boron (B)-Total (mg/dm2.day)		<0.00010	<0.00010		
	Cadmium (Cd)-Total (mg/dm2.day)		<0.00000060	0.00000068		
	Calcium (Ca)-Total (mg/dm2.day)		0.00347	0.00425		
	Chromium (Cr)-Total (mg/dm2.day)		<0.0000060	0.0000133		
	Cobalt (Co)-Total (mg/dm2.day)		<0.0000010	0.0000027		
	Copper (Cu)-Total (mg/dm2.day)		0.00188	0.0000798		
	Lead (Pb)-Total (mg/dm2.day)		0.00000229	0.00000207		
	Lithium (Li)-Total (mg/dm2.day)		<0.000060	<0.000060		
	Magnesium (Mg)-Total (mg/dm2.day)		0.00188	0.00376		
	Manganese (Mn)-Total (mg/dm2.day)		0.0000427	0.0000899		
	Mercury (Hg)-Total (mg/dm2.day)		<0.00000060	<0.00000060		
	Molybdenum (Mo)-Total (mg/dm2.day)		<0.00000060	0.00000068		
	Nickel (Ni)-Total (mg/dm2.day)		0.0000080	0.0000249		
	Potassium (K)-Total (mg/dm2.day)		0.00714	0.00503		
	Selenium (Se)-Total (mg/dm2.day)		<0.000010	<0.000010		
	Silver (Ag)-Total (mg/dm2.day)		0.00000018	0.00000018		
	Sodium (Na)-Total (mg/dm2.day)		0.00295	0.00312		
	Strontium (Sr)-Total (mg/dm2.day)		0.0000110	0.0000299		
	Thallium (Tl)-Total (mg/dm2.day)		<0.0000010	<0.0000010		
	Tin (Sn)-Total (mg/dm2.day)		0.0000021	0.0000017		
	Uranium (U)-Total (mg/dm2.day)		0.00000015	0.00000038		
	Vanadium (V)-Total (mg/dm2.day)		<0.000010	<0.000010		
	Zinc (Zn)-Total (mg/dm2.day)		0.000291	0.000148		

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS LABORATORY GROUP ANALYTICAL REPORT

Sample ID Description Sampled Date Sampled Time Client ID		L667852-21	L667852-22	L667852-23	L667852-24	L667852-25
		05-JUL-08 15:55 AQ-49-P	05-JUL-08 16:10 AQ-54-M	05-JUL-08 16:10 AQ-54-P	05-JUL-08 14:15 FOX-D300-M	05-JUL-08 14:15 FOX-D300-P
Grouping	Analyte					
DUSTFALL						
Particulates	Total Dustfall (mg/dm2.day)	0.13		0.12		1.03
	Total Insoluble Dustfall (mg/dm2.day)	<0.10		<0.10		0.93
	Total Soluble Dustfall (mg/dm2.day)	0.13		0.15		<0.10
Anions and Nutrients	Nitrate (as N) (mg/dm2.day)	0.000594		0.000773		0.000669
	Sulfate (SO4) (mg/dm2.day)	<0.0030		0.0029		0.0041
Metals	Aluminum (Al)-Total (mg/dm2.day)		0.000241		0.0338	
	Antimony (Sb)-Total (mg/dm2.day)		<0.000010		<0.000010	
	Arsenic (As)-Total (mg/dm2.day)		<0.000010		0.0000020	
	Barium (Ba)-Total (mg/dm2.day)		0.00000712		0.000530	
	Beryllium (Be)-Total (mg/dm2.day)		<0.0000060		<0.0000060	
	Bismuth (Bi)-Total (mg/dm2.day)		<0.0000060		<0.0000060	
	Boron (B)-Total (mg/dm2.day)		<0.00010		<0.00010	
	Cadmium (Cd)-Total (mg/dm2.day)		<0.00000060		<0.00000060	
	Calcium (Ca)-Total (mg/dm2.day)		0.00291		0.0148	
	Chromium (Cr)-Total (mg/dm2.day)		<0.0000060		0.000119	
	Cobalt (Co)-Total (mg/dm2.day)		<0.0000010		0.0000252	
	Copper (Cu)-Total (mg/dm2.day)		0.00194		0.00280	
	Lead (Pb)-Total (mg/dm2.day)		0.00000143		0.00000919	
	Lithium (Li)-Total (mg/dm2.day)		<0.000060		<0.000060	
	Magnesium (Mg)-Total (mg/dm2.day)		0.000744		0.0338	
	Manganese (Mn)-Total (mg/dm2.day)		0.0000697		0.000528	
	Mercury (Hg)-Total (mg/dm2.day)		<0.00000060		<0.00000060	
	Molybdenum (Mo)-Total (mg/dm2.day)		<0.00000060		0.00000162	
	Nickel (Ni)-Total (mg/dm2.day)		0.0000100		0.000157	
	Potassium (K)-Total (mg/dm2.day)		0.00261		0.0219	
	Selenium (Se)-Total (mg/dm2.day)		<0.000010		<0.000010	
	Silver (Ag)-Total (mg/dm2.day)		<0.00000010		0.00000025	
	Sodium (Na)-Total (mg/dm2.day)		0.00077		0.00518	
	Strontium (Sr)-Total (mg/dm2.day)		0.0000094		0.000162	
	Thallium (Tl)-Total (mg/dm2.day)		<0.0000010		<0.0000010	
	Tin (Sn)-Total (mg/dm2.day)		0.0000013		0.0000016	
	Uranium (U)-Total (mg/dm2.day)		<0.00000010		0.00000139	
	Vanadium (V)-Total (mg/dm2.day)		<0.000010		0.000098	
	Zinc (Zn)-Total (mg/dm2.day)		0.000229		0.000210	

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS LABORATORY GROUP ANALYTICAL REPORT

Sample ID Description Sampled Date Sampled Time Client ID		L667852-26	L667852-27	L667852-28	L667852-29	L667852-30
Grouping Analyte						
DUSTFALL						
Particulates	Total Dustfall (mg/dm2.day)		<0.10		<0.10	
	Total Insoluble Dustfall (mg/dm2.day)		<0.10		<0.10	
	Total Soluble Dustfall (mg/dm2.day)		<0.10		<0.10	
Anions and Nutrients	Nitrate (as N) (mg/dm2.day)		0.00121		0.000340	
	Sulfate (SO4) (mg/dm2.day)		0.0192		0.0031	
Metals	Aluminum (Al)-Total (mg/dm2.day)	0.0848		0.00690		0.0104
	Antimony (Sb)-Total (mg/dm2.day)	<0.000030		<0.000010		<0.000010
	Arsenic (As)-Total (mg/dm2.day)	0.0000037		0.0000016		0.0000017
	Barium (Ba)-Total (mg/dm2.day)	0.00142		0.000131		0.000215
	Beryllium (Be)-Total (mg/dm2.day)	<0.000010		<0.0000060		<0.0000060
	Bismuth (Bi)-Total (mg/dm2.day)	<0.000010		<0.0000060		<0.0000060
	Boron (B)-Total (mg/dm2.day)	<0.00030		<0.00010		<0.00010
	Cadmium (Cd)-Total (mg/dm2.day)	<0.0000010		0.00000070		<0.00000060
	Calcium (Ca)-Total (mg/dm2.day)	0.0362		0.00409		0.00922
	Chromium (Cr)-Total (mg/dm2.day)	0.000289		0.0000355		0.0000480
	Cobalt (Co)-Total (mg/dm2.day)	0.0000646		0.0000062		0.0000095
	Copper (Cu)-Total (mg/dm2.day)	0.000744		0.00180		0.00142
	Lead (Pb)-Total (mg/dm2.day)	0.0000125		0.00000248		0.00000307
	Lithium (Li)-Total (mg/dm2.day)	0.00013		<0.000060		<0.000060
	Magnesium (Mg)-Total (mg/dm2.day)	0.0867		0.00868		0.0131
	Manganese (Mn)-Total (mg/dm2.day)	0.00120		0.000143		0.000225
	Mercury (Hg)-Total (mg/dm2.day)	<0.00000060		<0.00000060		<0.00000060
	Molybdenum (Mo)-Total (mg/dm2.day)	0.0000037		0.00000090		0.00000132
	Nickel (Ni)-Total (mg/dm2.day)	0.000423		0.0000559		0.0000713
	Potassium (K)-Total (mg/dm2.day)	0.0594		0.0124		0.0101
	Selenium (Se)-Total (mg/dm2.day)	<0.000030		<0.000010		<0.000010
	Silver (Ag)-Total (mg/dm2.day)	<0.00000030		<0.00000010		0.00000093
	Sodium (Na)-Total (mg/dm2.day)	0.0157		0.00276		0.00278
	Strontium (Sr)-Total (mg/dm2.day)	0.000456		0.0000372		0.0000816
	Thallium (Tl)-Total (mg/dm2.day)	<0.0000030		<0.0000010		<0.0000010
	Tin (Sn)-Total (mg/dm2.day)	<0.0000030		<0.0000010		0.0000017
	Uranium (U)-Total (mg/dm2.day)	0.00000423		0.00000095		0.00000080
	Vanadium (V)-Total (mg/dm2.day)	0.000246		0.000021		0.000034
	Zinc (Zn)-Total (mg/dm2.day)	0.000454		0.000123		0.000147

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS LABORATORY GROUP ANALYTICAL REPORT

		Sample ID				
		Description				
		Sampled Date				
		Sampled Time				
		Client ID				
Grouping	Analyte					
DUSTFALL						
Particulates	Total Dustfall (mg/dm2.day)		0.31		1.32	
	Total Insoluble Dustfall (mg/dm2.day)		0.15		1.05	
	Total Soluble Dustfall (mg/dm2.day)		0.16		0.27	
Anions and Nutrients	Nitrate (as N) (mg/dm2.day)		0.00122		0.000807	
	Sulfate (SO4) (mg/dm2.day)		0.0536		0.0426	
Metals	Aluminum (Al)-Total (mg/dm2.day)	0.00388		0.00883		
	Antimony (Sb)-Total (mg/dm2.day)	<0.0000010		<0.0000010		
	Arsenic (As)-Total (mg/dm2.day)	<0.0000010		0.0000016		
	Barium (Ba)-Total (mg/dm2.day)	0.000146		0.000416		
	Beryllium (Be)-Total (mg/dm2.day)	<0.0000060		<0.0000060		
	Bismuth (Bi)-Total (mg/dm2.day)	<0.0000060		<0.0000060		
	Boron (B)-Total (mg/dm2.day)	<0.00010		<0.00010		
	Cadmium (Cd)-Total (mg/dm2.day)	<0.00000060		<0.00000060		
	Calcium (Ca)-Total (mg/dm2.day)	0.00738		0.0186		
	Chromium (Cr)-Total (mg/dm2.day)	0.0000308		0.0000753		
	Cobalt (Co)-Total (mg/dm2.day)	0.0000075		0.0000177		
	Copper (Cu)-Total (mg/dm2.day)	0.00159		0.00126		
	Lead (Pb)-Total (mg/dm2.day)	0.00000256		0.00000378		
	Lithium (Li)-Total (mg/dm2.day)	<0.000060		<0.000060		
	Magnesium (Mg)-Total (mg/dm2.day)	0.0130		0.0318		
	Manganese (Mn)-Total (mg/dm2.day)	0.000128		0.000306		
	Mercury (Hg)-Total (mg/dm2.day)	<0.00000060		<0.00000060		
	Molybdenum (Mo)-Total (mg/dm2.day)	0.0000163		0.00000660		
	Nickel (Ni)-Total (mg/dm2.day)	0.000108		0.000245		
	Potassium (K)-Total (mg/dm2.day)	0.00453		0.00722		
	Selenium (Se)-Total (mg/dm2.day)	<0.000010		<0.000010		
	Silver (Ag)-Total (mg/dm2.day)	<0.00000010		0.00000014		
	Sodium (Na)-Total (mg/dm2.day)	0.0288		0.00214		
	Strontium (Sr)-Total (mg/dm2.day)	0.000144		0.000300		
	Thallium (Tl)-Total (mg/dm2.day)	<0.0000010		<0.0000010		
	Tin (Sn)-Total (mg/dm2.day)	<0.0000010		0.0000015		
	Uranium (U)-Total (mg/dm2.day)	0.00000039		0.00000089		
	Vanadium (V)-Total (mg/dm2.day)	<0.000010		0.000027		
	Zinc (Zn)-Total (mg/dm2.day)	0.000119		0.000105		

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

Reference Information

Methods Listed (if applicable):

ALS Test Code	Matrix	Test Description	Analytical Method Reference(Based On)
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ANIONS-DUSTNO3-IC-VA Dustfall Dustfall Nitrate by Ion Chromatography BC LAB MAN. - PART. - SOLUBLE - ANIONS

The Dustfall analysis is carried out in accordance with the B.C. Laboratory Manual method 'Particulate - Total' and 'Particulate - Soluble - Anions and Cations by Ion Chromatography'. The nitrate analysis is specifically carried out using procedures adapted from APHA Method 4110 "Determination of Anions by Ion Chromatography" and EPA Method 300.0 "Determination of Inorganic Anions by Ion Chromatography".

ANIONS-DUSTSO4-IC-VA Dustfall Dustfall Sulphate by Ion Chromatography BC LAB MAN. - PART. - SOLUBLE - ANIONS

The Dustfall analysis is carried out in accordance with the B.C. Laboratory Manual method 'Particulate - Total' and 'Particulate - Soluble - Anions and Cations by Ion Chromatography'. The sulphate analysis is specifically carried out using procedures adapted from APHA Method 4110 "Determination of Anions by Ion Chromatography" and EPA Method 300.0 "Determination of Inorganic Anions by Ion Chromatography".

DUSTFALLS-COM-DM2-VA Dustfall Combined dustfalls-Total, soluble, insol BCMOE "DUSTFALLS"

Dustfall analysis is carried out in accordance with procedures published by the B.C. Ministry of Environment Laboratory.

HG-DUST(DM2-CVAFS-VA) Dustfall Total Mercury in Dustfalls by CVAFS EPA 245.7

This analysis is carried out using procedures adapted from "Standard Methods for the Examination of Water and Wastewater" published by the American Public Health Association, and with procedures adapted from "Test Methods for Evaluating Solid Waste" SW-846 published by the United States Environmental Protection Agency (EPA). Instrumental analysis is by cold vapour atomic fluorescence spectrophotometry (EPA Method 245.7).

MET-DUST(DM2)-MS-VA Dustfall Total Metals in Dustfalls by ICPMS EPA 6020A

This analysis is carried out using procedures adapted from "Standard Methods for the Examination of Water and Wastewater" published by the American Public Health Association, and with procedures adapted from "Test Methods for Evaluating Solid Waste" SW-846 published by the United States Environmental Protection Agency (EPA). Instrumental analysis is by inductively coupled plasma - mass spectrometry (EPA Method 6020A).

**** Laboratory Methods employed follow in-house procedures, which are generally based on nationally or internationally accepted methodologies. The last two letters of the above ALS Test Code column indicate the laboratory that performed analytical analysis for that test. Refer to the list below:**

Laboratory Definition Code	Laboratory Location	Laboratory Definition Code	Laboratory Location
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VA	ALS LABORATORY GROUP - VANCOUVER, BC, CANADA
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GLOSSARY OF REPORT TERMS

Surr - A surrogate is an organic compound that is similar to the target analyte(s) in chemical composition and behavior but not normally detected in environmental samples. Prior to sample processing, samples are fortified with one or more surrogate compounds.

The reported surrogate recovery value provides a measure of method efficiency.

mg/kg (units) - unit of concentration based on mass, parts per million

mg/L (units) - unit of concentration based on volume, parts per million

N/A - Result not available. Refer to qualifier code and definition for explanation

Test results reported relate only to the samples as received by the laboratory.

UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.

Although test results are generated under strict QA/QC protocols, any unsigned test reports, faxes, or emails are considered preliminary.

ALS Laboratory Group has an extensive QA/QC program where all analytical data reported is analyzed using approved referenced procedures followed by checks and reviews by senior managers and quality assurance personnel. However, since the results are obtained from chemical measurements and thus cannot be guaranteed, ALS Laboratory Group assumes no liability for the use or interpretation of the results.

CHAIN OF CUSTODY FORM

Station ID	Matrix	Date	Time	Init	Dustfall Metals	Insoluble Particulate	Nitrate	Soluble Particulate	Sulphate	Total Particulate
AQ-49-M	Dust	05-Jul-2008	03:55 PM	SH	1					BHP2
Fox-D90-M	Dust	05-Jul-2008	02:05 PM	SH	1					BHP2
Fox-D90-P	Dust	05-Jul-2008	02:05 PM	SH		1	1	1	1	BHP2
Fox-U30-M	Dust	05-Jul-2008	01:40 PM	SH	1					BHP2
Mis-D300-M	Dust	05-Jul-2008	10:45 AM	SH	1					BHP2
Mis-D300-P	Dust	05-Jul-2008	10:45 AM	SH	1	1	1	1	1	BHP2
Mis-D30-M	Dust	05-Jul-2008	10:20 AM	SH	1					BHP2
Mis-D30-P	Dust	05-Jul-2008	10:20 AM	SH	1	1	1	1	1	BHP2
Mis-D90-M	Dust	05-Jul-2008	10:35 AM	SH	1					BHP2
Mis-D90-P	Dust	05-Jul-2008	10:35 AM	SH	1	1	1	1	1	BHP2
Mis-U30-M	Dust	05-Jul-2008	10:15 AM	SH	1					BHP2
Mis-U30-P	Dust	05-Jul-2008	10:15 AM	SH	1	1	1	1	1	BHP2
FOX-D1000-P	Dust	05-Jul-2008	01:40 PM	SH	1	1	1	1	1	BHP2
FOX-D1000-M	Dust	05-Jul-2008	03:45 PM	SH	1	1	1	1	1	BHP2
MIS-D1000-P	Dust	05-Jul-2008	03:45 PM	SH	1	1	1	1	1	BHP2
MIS-D1000-M	Dust	05-Jul-2008	03:35 PM	SH	1	1	1	1	1	BHP2
Air-P125-M	Dust	05-Jul-2008	03:35 PM	SH	1					BHP2
Air-P125-P	Dust	05-Jul-2008	09:30 AM	SH	1	1	1	1	1	BHP2
Air-P280-P	Dust	05-Jul-2008	09:30 AM	SH	1	1	1	1	1	BHP2
Air-P280-M	Dust	05-Jul-2008	01:20 PM	SH	1	1	1	1	1	BHP2

Turn around Required: Regular	Received by: RB	Date: Aug 12
Special Instructions (Billing details, QC reporting, etc):	Received by:	Time: 10:16
Billing Code: BHP2503		
FOR LAB USE ONLY		
Relinquished by: [Signature]	Relinquished by:	
Date: 5 Aug 08	Date:	
Time: 16:05	Time:	
Cooler seal intact upon receipt? <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A		
Sample temperature upon receipt: 11 C.		
Frozen? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No		
Send Analytical Results to:		



ALS Environmental
excellence in analytical testing

1988 Triumph Street, Vancouver, BC V5L 1K5

Tel: 604-253-4188 Toll Free: 1-800-665-0243 Fax: 604-253-6700

ALS Contact: Can Dang



Form 61693

BHP Billiton Diamonds Inc.

1102 4920 52nd Street, Yellowknife, NT X1A 3T1

Tel: 867-880-2157 Fax: 867-880-4012

BHP Contacts: David Bruce/ Richard EhlerDavid

CHAIN OF CUSTODY FORM

Station ID	Matrix	Date	Time	Init	Dustfall Metals	Insoluble Particulate	Nitrate	Soluable Particulate	Sulphate	Total Particulate
AQ-49-P	Dust	05-Jul-2008	03:55 PM	SH	1	1	1	1	1	BHP2
AQ-54-M	Dust	05-Jul-2008	04:10 PM	SH	1	1	1	1	1	BHP2
AQ-54-P	Dust	05-Jul-2008	04:10 PM	SH	1	1	1	1	1	BHP2
Fox-D300-M	Dust	05-Jul-2008	02:15 PM	SH	1	1	1	1	1	BHP2
Fox-D300-P	Dust	05-Jul-2008	02:15 PM	SH	1	1	1	1	1	BHP2
Fox-D30-M	Dust	05-Jul-2008	01:45 PM	SH	1	1	1	1	1	BHP2
Fox-D30-P	Dust	05-Jul-2008	01:45 PM	SH	1	1	1	1	1	BHP2
Air-P162-M	Dust	05-Jul-2008	09:45 AM	SH	1	1	1	1	1	BHP2
Air-P162-P	Dust	05-Jul-2008	09:45 AM	SH	1	1	1	1	1	BHP2
Air-P280-M	Dust	05-Jul-2008	01:20 PM	SH	1	1	1	1	1	BHP2
LLCF-PA-M	Dust	05-Jul-2008	02:38 PM	SH	1	1	1	1	1	BHP2
LLCF-PA-P	Dust	05-Jul-2008	02:38 PM	SH	1	1	1	1	1	BHP2
LLCF-PB-M	Dust	05-Jul-2008	02:50 PM	SH	1	1	1	1	1	BHP2
LLCF-PB-P	Dust	05-Jul-2008	02:50 PM	SH	1	1	1	1	1	BHP2

For Lab Use

FOR LAB USE ONLY

Turn around Required: regular

Special Instructions (Billing details, QC reporting, etc):

Billing Code: BHP2503

Relinquished by:	Date Time	Received by:	Date Time
		RB	Aug 12 1016
Relinquished by:	Date Time	Received by:	Date Time

FOR LAB USE ONLY

Cooler seal intact upon receipt?

☒ Yes ☐ No ☐ N/A

Sample temperature upon receipt:

11 c.

Frozen?

☐ Yes ☒ No

Send Analytical Results to:

compliance.team@bhpbilliton.com;



Environmental Division

Certificate of Analysis

BHP BILLITON DIAMONDS INC.

ATTN: RICHARD EHLERT

1102 - 4920 52ND STREET

YELLOWKNIFE NT X1A 3T1

Reported On: 26-SEP-08 05:18 PM

Lab Work Order #: L680683

Date Received: 10-SEP-08

Project P.O. #: BHP2503

Job Reference: 61725

Legal Site Desc: 6200503513

CofC Numbers: 61725

Other Information:

Comments:

Can Dang
Account Manager

THIS REPORT SHALL NOT BE REPRODUCED EXCEPT IN FULL WITHOUT THE WRITTEN AUTHORITY OF THE LABORATORY.
ALL SAMPLES WILL BE DISPOSED OF AFTER 30 DAYS FOLLOWING ANALYSIS. PLEASE CONTACT THE LAB IF YOU
REQUIRE ADDITIONAL SAMPLE STORAGE TIME.

ALS LABORATORY GROUP ANALYTICAL REPORT

		Sample ID Description Sampled Date Sampled Time Client ID	L680683-1	L680683-2	L680683-3	L680683-4	L680683-5
Grouping	Analyte						
DUSTFALL							
Particulates	Total Dustfall (mg/dm2.day)		3.29		0.95		
	Total Insoluble Dustfall (mg/dm2.day)		2.98		0.69		
	Total Soluble Dustfall (mg/dm2.day)		0.31		0.26		
Anions and Nutrients	Nitrate (as N) (mg/dm2.day)		0.00196		0.00210		
	Sulfate (SO4) (mg/dm2.day)		0.018		0.012		
Metals	Aluminum (Al)-Total (mg/dm2.day)			0.00681		0.0294	0.000617
	Antimony (Sb)-Total (mg/dm2.day)			<0.0000020		<0.0000020	<0.0000030
	Arsenic (As)-Total (mg/dm2.day)			<0.0000020		0.0000032	<0.0000030
	Barium (Ba)-Total (mg/dm2.day)			0.000161		0.000678	0.0000264
	Beryllium (Be)-Total (mg/dm2.day)			<0.000010		<0.000010	<0.000010
	Bismuth (Bi)-Total (mg/dm2.day)			<0.000010		<0.000010	<0.000010
	Boron (B)-Total (mg/dm2.day)			<0.000020		<0.000020	<0.000030
	Cadmium (Cd)-Total (mg/dm2.day)			<0.0000010		<0.0000010	<0.0000010
	Calcium (Ca)-Total (mg/dm2.day)			0.00594		0.0172	0.00249
	Chromium (Cr)-Total (mg/dm2.day)			0.000021		0.000100	<0.000010
	Cobalt (Co)-Total (mg/dm2.day)			0.0000049		0.0000242	<0.0000030
	Copper (Cu)-Total (mg/dm2.day)			0.00299		0.00315	0.00318
	Lead (Pb)-Total (mg/dm2.day)			0.0000106		0.0000250	0.0000044
	Lithium (Li)-Total (mg/dm2.day)			<0.000010		<0.000010	<0.000010
	Magnesium (Mg)-Total (mg/dm2.day)			0.00653		0.0312	0.00063
	Manganese (Mn)-Total (mg/dm2.day)			0.000144		0.000461	0.0000400
	Mercury (Hg)-Total (mg/dm2.day)			<0.0000010		<0.0000010	<0.0000010
	Molybdenum (Mo)-Total (mg/dm2.day)			0.0000012		0.0000020	<0.0000010
	Nickel (Ni)-Total (mg/dm2.day)			0.000040		0.000187	<0.000010
	Potassium (K)-Total (mg/dm2.day)			0.0055		0.0229	<0.0010
	Selenium (Se)-Total (mg/dm2.day)			<0.000020		<0.000020	<0.000030
	Silver (Ag)-Total (mg/dm2.day)			0.00000025		0.00000035	0.00000040
	Sodium (Na)-Total (mg/dm2.day)			0.0020		0.0058	<0.0010
	Strontium (Sr)-Total (mg/dm2.day)			0.0000504		0.000197	0.0000073
	Thallium (Tl)-Total (mg/dm2.day)			<0.0000020		<0.0000020	<0.0000030
	Tin (Sn)-Total (mg/dm2.day)			0.0000021		0.0000058	<0.0000030
	Uranium (U)-Total (mg/dm2.day)			0.00000024		0.00000153	<0.00000030
	Vanadium (V)-Total (mg/dm2.day)			<0.000020		0.000079	<0.000030
	Zinc (Zn)-Total (mg/dm2.day)			0.000343		0.000234	0.000129

ALS LABORATORY GROUP ANALYTICAL REPORT

Sample ID Description Sampled Date Sampled Time Client ID		L680683-6	L680683-7	L680683-8	L680683-9	L680683-10
		05-AUG-08 11:45 MIS-D300-P	05-AUG-08 11:25 MIS-D30-M	05-AUG-08 11:25 MIS-D30-P	05-AUG-08 11:35 MIS-D90-M	05-AUG-08 11:35 MIS-D90-P
Grouping	Analyte					
DUSTFALL						
Particulates	Total Dustfall (mg/dm2.day)	0.32		0.57		0.33
	Total Insoluble Dustfall (mg/dm2.day)	<0.10		0.35		0.12
	Total Soluble Dustfall (mg/dm2.day)	0.22		0.22		0.20
Anions and Nutrients	Nitrate (as N) (mg/dm2.day)	0.00182		0.00222		0.00244
	Sulfate (SO4) (mg/dm2.day)	0.014		0.017		0.017
Metals	Aluminum (Al)-Total (mg/dm2.day)		0.00245		0.00131	
	Antimony (Sb)-Total (mg/dm2.day)		<0.0000030		<0.0000020	
	Arsenic (As)-Total (mg/dm2.day)		<0.0000030		<0.0000020	
	Barium (Ba)-Total (mg/dm2.day)		0.0000625		0.0000284	
	Beryllium (Be)-Total (mg/dm2.day)		<0.000010		<0.000010	
	Bismuth (Bi)-Total (mg/dm2.day)		<0.000010		<0.000010	
	Boron (B)-Total (mg/dm2.day)		<0.00030		<0.00020	
	Cadmium (Cd)-Total (mg/dm2.day)		<0.0000010		<0.0000010	
	Calcium (Ca)-Total (mg/dm2.day)		0.00336		0.00335	
	Chromium (Cr)-Total (mg/dm2.day)		<0.000010		<0.000010	
	Cobalt (Co)-Total (mg/dm2.day)		<0.0000030		<0.0000020	
	Copper (Cu)-Total (mg/dm2.day)		0.000403		0.00339	
	Lead (Pb)-Total (mg/dm2.day)		0.0000041		0.0000049	
	Lithium (Li)-Total (mg/dm2.day)		<0.00010		<0.00010	
	Magnesium (Mg)-Total (mg/dm2.day)		0.00219		0.00101	
	Manganese (Mn)-Total (mg/dm2.day)		0.0000680		0.0000558	
	Mercury (Hg)-Total (mg/dm2.day)		<0.0000010		<0.0000010	
	Molybdenum (Mo)-Total (mg/dm2.day)		<0.0000010		<0.0000010	
	Nickel (Ni)-Total (mg/dm2.day)		0.000020		0.000016	
	Potassium (K)-Total (mg/dm2.day)		0.0026		0.0017	
	Selenium (Se)-Total (mg/dm2.day)		<0.000030		<0.000020	
	Silver (Ag)-Total (mg/dm2.day)		<0.00000030		<0.00000020	
	Sodium (Na)-Total (mg/dm2.day)		<0.0010		0.0013	
	Strontium (Sr)-Total (mg/dm2.day)		0.0000136		0.0000096	
	Thallium (Tl)-Total (mg/dm2.day)		<0.0000030		<0.0000020	
	Tin (Sn)-Total (mg/dm2.day)		<0.0000030		<0.0000020	
	Uranium (U)-Total (mg/dm2.day)		<0.00000030		<0.00000020	
	Vanadium (V)-Total (mg/dm2.day)		<0.000030		<0.000020	
	Zinc (Zn)-Total (mg/dm2.day)		0.000091		0.000344	

ALS LABORATORY GROUP ANALYTICAL REPORT

		Sample ID				
		Description				
		Sampled Date				
		Sampled Time				
		Client ID				
Grouping	Analyte					
DUSTFALL						
Particulates	Total Dustfall (mg/dm2.day)		0.38	2.00	0.37	
	Total Insoluble Dustfall (mg/dm2.day)		0.23	1.73	0.21	
	Total Soluble Dustfall (mg/dm2.day)		0.15	0.26	0.16	
Anions and Nutrients	Nitrate (as N) (mg/dm2.day)		0.00238	0.00183	0.00161	
	Sulfate (SO4) (mg/dm2.day)		0.017	0.013	0.0095	
Metals	Aluminum (Al)-Total (mg/dm2.day)	0.00100				0.00112
	Antimony (Sb)-Total (mg/dm2.day)	<0.0000020				<0.0000020
	Arsenic (As)-Total (mg/dm2.day)	<0.0000020				<0.0000020
	Barium (Ba)-Total (mg/dm2.day)	0.0000706				0.0000685
	Beryllium (Be)-Total (mg/dm2.day)	<0.000010				<0.0000080
	Bismuth (Bi)-Total (mg/dm2.day)	<0.000010				<0.0000080
	Boron (B)-Total (mg/dm2.day)	<0.00020				<0.00020
	Cadmium (Cd)-Total (mg/dm2.day)	<0.0000010				<0.00000080
	Calcium (Ca)-Total (mg/dm2.day)	0.00479				0.00508
	Chromium (Cr)-Total (mg/dm2.day)	<0.000010				<0.0000080
	Cobalt (Co)-Total (mg/dm2.day)	0.0000027				<0.0000020
	Copper (Cu)-Total (mg/dm2.day)	0.00333				0.00297
	Lead (Pb)-Total (mg/dm2.day)	0.0000039				0.00000303
	Lithium (Li)-Total (mg/dm2.day)	<0.00010				<0.000080
	Magnesium (Mg)-Total (mg/dm2.day)	0.00144				0.00159
	Manganese (Mn)-Total (mg/dm2.day)	0.000158				0.0000633
	Mercury (Hg)-Total (mg/dm2.day)	<0.0000010				<0.00000080
	Molybdenum (Mo)-Total (mg/dm2.day)	<0.0000010				<0.00000080
	Nickel (Ni)-Total (mg/dm2.day)	0.000013				0.0000132
	Potassium (K)-Total (mg/dm2.day)	0.0015				0.00346
	Selenium (Se)-Total (mg/dm2.day)	<0.000020				<0.000020
	Silver (Ag)-Total (mg/dm2.day)	<0.00000020				0.00000036
	Sodium (Na)-Total (mg/dm2.day)	<0.0010				0.00122
	Strontium (Sr)-Total (mg/dm2.day)	0.0000197				0.0000205
	Thallium (Tl)-Total (mg/dm2.day)	<0.0000020				<0.0000020
	Tin (Sn)-Total (mg/dm2.day)	<0.0000020				<0.0000020
	Uranium (U)-Total (mg/dm2.day)	<0.00000020				<0.00000020
	Vanadium (V)-Total (mg/dm2.day)	<0.000020				<0.000020
	Zinc (Zn)-Total (mg/dm2.day)	0.000514				0.000289

ALS LABORATORY GROUP ANALYTICAL REPORT

		Sample ID				
		Description				
		Sampled Date				
		Sampled Time				
		Client ID				
Grouping	Analyte					
DUSTFALL						
Particulates	Total Dustfall (mg/dm2.day)	0.26				0.72
	Total Insoluble Dustfall (mg/dm2.day)	0.20				0.42
	Total Soluble Dustfall (mg/dm2.day)	<0.10				0.30
Anions and Nutrients	Nitrate (as N) (mg/dm2.day)	0.00249				0.000909
	Sulfate (SO4) (mg/dm2.day)	0.014				0.0221
Metals	Aluminum (Al)-Total (mg/dm2.day)		0.000699	0.00191	0.00104	
	Antimony (Sb)-Total (mg/dm2.day)		<0.0000020	<0.0000020	<0.0000020	
	Arsenic (As)-Total (mg/dm2.day)		<0.0000020	<0.0000020	<0.0000020	
	Barium (Ba)-Total (mg/dm2.day)		0.0000211	0.000102	0.0000552	
	Beryllium (Be)-Total (mg/dm2.day)		<0.000010	<0.000010	<0.0000090	
	Bismuth (Bi)-Total (mg/dm2.day)		<0.000010	<0.000010	<0.0000090	
	Boron (B)-Total (mg/dm2.day)		<0.00020	<0.00020	<0.00020	
	Cadmium (Cd)-Total (mg/dm2.day)		<0.0000010	<0.0000010	0.00000193	
	Calcium (Ca)-Total (mg/dm2.day)		0.00178	0.00383	0.00509	
	Chromium (Cr)-Total (mg/dm2.day)		<0.000010	<0.000010	<0.0000090	
	Cobalt (Co)-Total (mg/dm2.day)		<0.0000020	<0.0000020	0.0000022	
	Copper (Cu)-Total (mg/dm2.day)		0.00328	0.000630	0.00230	
	Lead (Pb)-Total (mg/dm2.day)		0.0000027	0.0000032	0.00000229	
	Lithium (Li)-Total (mg/dm2.day)		<0.00010	<0.00010	<0.000090	
	Magnesium (Mg)-Total (mg/dm2.day)		0.00087	0.00210	0.00576	
	Manganese (Mn)-Total (mg/dm2.day)		0.0000414	0.0000785	0.0000822	
	Mercury (Hg)-Total (mg/dm2.day)		<0.0000010	<0.0000010	<0.00000090	
	Molybdenum (Mo)-Total (mg/dm2.day)		<0.0000010	<0.0000010	0.00000160	
	Nickel (Ni)-Total (mg/dm2.day)		<0.000010	0.000023	0.0000385	
	Potassium (K)-Total (mg/dm2.day)		0.0014	0.0034	0.0227	
	Selenium (Se)-Total (mg/dm2.day)		<0.000020	<0.000020	<0.000020	
	Silver (Ag)-Total (mg/dm2.day)		<0.00000020	<0.00000020	0.00000031	
	Sodium (Na)-Total (mg/dm2.day)		<0.0010	<0.0010	0.0130	
	Strontium (Sr)-Total (mg/dm2.day)		0.0000071	0.0000227	0.0000424	
	Thallium (Tl)-Total (mg/dm2.day)		<0.0000020	<0.0000020	<0.0000020	
	Tin (Sn)-Total (mg/dm2.day)		<0.0000020	0.0000043	<0.0000020	
	Uranium (U)-Total (mg/dm2.day)		<0.00000020	0.00000024	<0.00000020	
	Vanadium (V)-Total (mg/dm2.day)		<0.000020	<0.000020	<0.000020	
	Zinc (Zn)-Total (mg/dm2.day)		0.000110	0.000140	0.000219	

ALS LABORATORY GROUP ANALYTICAL REPORT

Sample ID Description Sampled Date Sampled Time Client ID		L680683-21	L680683-22	L680683-23	L680683-24	L680683-25
Grouping Analyte						
DUSTFALL						
Particulates	Total Dustfall (mg/dm2.day)		1.38		0.21	
	Total Insoluble Dustfall (mg/dm2.day)		1.22		0.11	
	Total Soluble Dustfall (mg/dm2.day)		0.16		0.10	
Anions and Nutrients	Nitrate (as N) (mg/dm2.day)		0.000194		0.00160	
	Sulfate (SO4) (mg/dm2.day)		<0.0040		<0.010	
Metals	Aluminum (Al)-Total (mg/dm2.day)	0.000615		0.000467		0.00533
	Antimony (Sb)-Total (mg/dm2.day)	<0.0000020		<0.0000020		<0.0000020
	Arsenic (As)-Total (mg/dm2.day)	<0.0000020		<0.0000020		<0.0000020
	Barium (Ba)-Total (mg/dm2.day)	0.0000226		0.0000144		0.000122
	Beryllium (Be)-Total (mg/dm2.day)	<0.000010		<0.0000090		<0.000010
	Bismuth (Bi)-Total (mg/dm2.day)	<0.000010		<0.0000090		<0.000010
	Boron (B)-Total (mg/dm2.day)	<0.00020		<0.00020		<0.00020
	Cadmium (Cd)-Total (mg/dm2.day)	<0.0000010		<0.00000090		<0.0000010
	Calcium (Ca)-Total (mg/dm2.day)	0.0545		0.00225		0.00435
	Chromium (Cr)-Total (mg/dm2.day)	<0.000010		<0.0000090		0.000021
	Cobalt (Co)-Total (mg/dm2.day)	<0.0000020		<0.0000020		0.0000041
	Copper (Cu)-Total (mg/dm2.day)	0.00185		0.00267		0.00332
	Lead (Pb)-Total (mg/dm2.day)	0.0000019		0.00000158		0.0000023
	Lithium (Li)-Total (mg/dm2.day)	<0.00010		<0.000090		<0.00010
	Magnesium (Mg)-Total (mg/dm2.day)	0.00108		0.000514		0.00582
	Manganese (Mn)-Total (mg/dm2.day)	0.0000427		0.0000306		0.000108
	Mercury (Hg)-Total (mg/dm2.day)	<0.0000010		<0.00000090		<0.0000010
	Molybdenum (Mo)-Total (mg/dm2.day)	<0.0000010		<0.00000090		<0.0000010
	Nickel (Ni)-Total (mg/dm2.day)	0.000013		<0.0000090		0.000036
	Potassium (K)-Total (mg/dm2.day)	0.0015		<0.00090		0.0043
	Selenium (Se)-Total (mg/dm2.day)	<0.000020		<0.000020		<0.000020
	Silver (Ag)-Total (mg/dm2.day)	0.00000026		<0.00000020		<0.00000020
	Sodium (Na)-Total (mg/dm2.day)	0.0129		<0.00090		0.0016
	Strontium (Sr)-Total (mg/dm2.day)	0.0000330		0.0000060		0.0000361
	Thallium (Tl)-Total (mg/dm2.day)	<0.0000020		<0.0000020		<0.0000020
	Tin (Sn)-Total (mg/dm2.day)	<0.0000020		0.0000026		<0.0000020
	Uranium (U)-Total (mg/dm2.day)	<0.00000020		<0.00000020		0.00000025
	Vanadium (V)-Total (mg/dm2.day)	<0.000020		<0.000020		<0.000020
	Zinc (Zn)-Total (mg/dm2.day)	0.000076		0.000122		0.000058

ALS LABORATORY GROUP ANALYTICAL REPORT

		Sample ID				
		Description				
		Sampled Date				
		Sampled Time				
		Client ID				
Grouping	Analyte					
DUSTFALL						
Particulates	Total Dustfall (mg/dm2.day)	0.46		0.43		0.51
	Total Insoluble Dustfall (mg/dm2.day)	0.33		0.30		0.28
	Total Soluble Dustfall (mg/dm2.day)	0.14		0.13		0.23
Anions and Nutrients	Nitrate (as N) (mg/dm2.day)	0.00170		0.00218		0.00160
	Sulfate (SO4) (mg/dm2.day)	0.0103		0.013		0.012
Metals	Aluminum (Al)-Total (mg/dm2.day)		0.0303		0.00247	
	Antimony (Sb)-Total (mg/dm2.day)		<0.0000020		<0.0000020	
	Arsenic (As)-Total (mg/dm2.day)		0.0000024		<0.0000020	
	Barium (Ba)-Total (mg/dm2.day)		0.000581		0.0000751	
	Beryllium (Be)-Total (mg/dm2.day)		<0.000010		<0.000010	
	Bismuth (Bi)-Total (mg/dm2.day)		<0.000010		<0.000010	
	Boron (B)-Total (mg/dm2.day)		<0.00020		<0.00020	
	Cadmium (Cd)-Total (mg/dm2.day)		<0.0000010		<0.0000010	
	Calcium (Ca)-Total (mg/dm2.day)		0.0159		0.00554	
	Chromium (Cr)-Total (mg/dm2.day)		0.000099		<0.000010	
	Cobalt (Co)-Total (mg/dm2.day)		0.0000225		<0.0000020	
	Copper (Cu)-Total (mg/dm2.day)		0.00244		0.000754	
	Lead (Pb)-Total (mg/dm2.day)		0.0000106		0.0000052	
	Lithium (Li)-Total (mg/dm2.day)		<0.00010		<0.00010	
	Magnesium (Mg)-Total (mg/dm2.day)		0.0309		0.00303	
	Manganese (Mn)-Total (mg/dm2.day)		0.000462		0.0000801	
	Mercury (Hg)-Total (mg/dm2.day)		<0.0000010		<0.0000010	
	Molybdenum (Mo)-Total (mg/dm2.day)		0.0000018		<0.0000010	
	Nickel (Ni)-Total (mg/dm2.day)		0.000160		0.000027	
	Potassium (K)-Total (mg/dm2.day)		0.0207		0.0026	
	Selenium (Se)-Total (mg/dm2.day)		<0.000020		<0.000020	
	Silver (Ag)-Total (mg/dm2.day)		<0.00000020		<0.00000020	
	Sodium (Na)-Total (mg/dm2.day)		0.0056		<0.0010	
	Strontium (Sr)-Total (mg/dm2.day)		0.000180		0.0000230	
	Thallium (Tl)-Total (mg/dm2.day)		<0.0000020		<0.0000020	
	Tin (Sn)-Total (mg/dm2.day)		<0.0000020		<0.0000020	
	Uranium (U)-Total (mg/dm2.day)		0.00000117		0.00000025	
	Vanadium (V)-Total (mg/dm2.day)		0.000083		<0.000020	
	Zinc (Zn)-Total (mg/dm2.day)		0.000715		0.00110	

ALS LABORATORY GROUP ANALYTICAL REPORT

Sample ID Description Sampled Date Sampled Time Client ID		L680683-31	L680683-32	L680683-33	L680683-34	
		05-AUG-08 10:47 AIR-P280-M	05-AUG-08 10:47 AIR-P280-P	05-AUG-08 10:25 LLCF-PB-M	05-AUG-08 10:25 LLCF-PB-P	
Grouping	Analyte					
DUSTFALL						
Particulates	Total Dustfall (mg/dm2.day)		0.75		0.32	
	Total Insoluble Dustfall (mg/dm2.day)		0.67		0.18	
	Total Soluble Dustfall (mg/dm2.day)		<0.10		0.14	
Anions and Nutrients	Nitrate (as N) (mg/dm2.day)		0.00200		0.00192	
	Sulfate (SO4) (mg/dm2.day)		0.016		0.0121	
Metals	Aluminum (Al)-Total (mg/dm2.day)	0.00338		0.00112		
	Antimony (Sb)-Total (mg/dm2.day)	<0.0000020		<0.0000020		
	Arsenic (As)-Total (mg/dm2.day)	<0.0000020		<0.0000020		
	Barium (Ba)-Total (mg/dm2.day)	0.000106		0.000131		
	Beryllium (Be)-Total (mg/dm2.day)	<0.000010		<0.0000080		
	Bismuth (Bi)-Total (mg/dm2.day)	<0.000010		<0.0000080		
	Boron (B)-Total (mg/dm2.day)	<0.00020		<0.00020		
	Cadmium (Cd)-Total (mg/dm2.day)	0.0000014		<0.00000080		
	Calcium (Ca)-Total (mg/dm2.day)	0.00550		0.00863		
	Chromium (Cr)-Total (mg/dm2.day)	0.000015		<0.0000080		
	Cobalt (Co)-Total (mg/dm2.day)	0.0000042		0.0000041		
	Copper (Cu)-Total (mg/dm2.day)	0.00276		0.00181		
	Lead (Pb)-Total (mg/dm2.day)	0.0000033		0.00000260		
	Lithium (Li)-Total (mg/dm2.day)	<0.00010		<0.000080		
	Magnesium (Mg)-Total (mg/dm2.day)	0.00516		0.00443		
	Manganese (Mn)-Total (mg/dm2.day)	0.000107		0.000104		
	Mercury (Hg)-Total (mg/dm2.day)	<0.0000010		<0.00000080		
	Molybdenum (Mo)-Total (mg/dm2.day)	<0.0000010		0.00000205		
	Nickel (Ni)-Total (mg/dm2.day)	0.000045		0.0000392		
	Potassium (K)-Total (mg/dm2.day)	0.0033		0.00192		
	Selenium (Se)-Total (mg/dm2.day)	<0.000020		<0.000020		
	Silver (Ag)-Total (mg/dm2.day)	<0.00000020		0.00000034		
	Sodium (Na)-Total (mg/dm2.day)	0.0014		<0.00080		
	Strontium (Sr)-Total (mg/dm2.day)	0.0000372		0.000128		
	Thallium (Tl)-Total (mg/dm2.day)	<0.0000020		<0.0000020		
	Tin (Sn)-Total (mg/dm2.day)	<0.0000020		<0.0000020		
	Uranium (U)-Total (mg/dm2.day)	<0.00000020		<0.00000020		
	Vanadium (V)-Total (mg/dm2.day)	<0.000020		<0.000020		
	Zinc (Zn)-Total (mg/dm2.day)	0.000472		0.00146		

Reference Information

Additional Comments for Sample Listed:

Samplenum	Matrix	Report Remarks	Sample Comments
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Methods Listed (if applicable):

ALS Test Code	Matrix	Test Description	Analytical Method Reference(Based On)
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DUSTFALLS-COM-DM2-VA Dustfall Combined dustfalls-Total, soluble, insol BCMOE "DUSTFALLS"

Dustfall analysis is carried out in accordance with procedures published by the B.C. Ministry of Environment Laboratory.

HG-DUST(DM2-CVAFS-VA) Dustfall Total Mercury in Dustfalls by CVAFS EPA 245.7

This analysis is carried out using procedures adapted from "Standard Methods for the Examination of Water and Wastewater" published by the American Public Health Association, and with procedures adapted from "Test Methods for Evaluating Solid Waste" SW-846 published by the United States Environmental Protection Agency (EPA). Instrumental analysis is by cold vapour atomic fluorescence spectrophotometry (EPA Method 245.7).

MET-DUST(DM2)-MS-VA Dustfall Total Metals in Dustfalls by ICPMS EPA 6020A

This analysis is carried out using procedures adapted from "Standard Methods for the Examination of Water and Wastewater" published by the American Public Health Association, and with procedures adapted from "Test Methods for Evaluating Solid Waste" SW-846 published by the United States Environmental Protection Agency (EPA). Instrumental analysis is by inductively coupled plasma - mass spectrometry (EPA Method 6020A).

NO3-IC-VA Dustfall Dustfall Nitrate by Ion Chromatography BC LAB MAN. - PART. - SOLUBLE - ANIONS

The Dustfall analysis is carried out in accordance with the B.C. Laboratory Manual method 'Particulate - Total' and 'Particulate - Soluble - Anions and Cations by Ion Chromatography'. The nitrate analysis is specifically carried out using procedures adapted from APHA Method 4110 "Determination of Anions by Ion Chromatography" and EPA Method 300.0 "Determination of Inorganic Anions by Ion Chromatography".

SO4-IC-VA Dustfall Dustfall Sulphate by Ion Chromatography BC LAB MAN. - PART. - SOLUBLE - ANIONS

The Dustfall analysis is carried out in accordance with the B.C. Laboratory Manual method 'Particulate - Total' and 'Particulate - Soluble - Anions and Cations by Ion Chromatography'. The sulphate analysis is specifically carried out using procedures adapted from APHA Method 4110 "Determination of Anions by Ion Chromatography" and EPA Method 300.0 "Determination of Inorganic Anions by Ion Chromatography".

** Laboratory Methods employed follow in-house procedures, which are generally based on nationally or internationally accepted methodologies.

The last two letters of the above ALS Test Code column indicate the laboratory that performed analytical analysis for that test. Refer to the list below:

Laboratory Definition Code	Laboratory Location	Laboratory Definition Code	Laboratory Location
VA	ALS LABORATORY GROUP - VANCOUVER, BC, CANADA		

GLOSSARY OF REPORT TERMS

Surr - A surrogate is an organic compound that is similar to the target analyte(s) in chemical composition and behavior but not normally detected in environmental samples. Prior to sample processing, samples are fortified with one or more surrogate compounds.

The reported surrogate recovery value provides a measure of method efficiency.

mg/kg (units) - unit of concentration based on mass, parts per million

mg/L (units) - unit of concentration based on volume, parts per million

N/A - Result not available. Refer to qualifier code and definition for explanation

Test results reported relate only to the samples as received by the laboratory.

UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.

Although test results are generated under strict QA/QC protocols, any unsigned test reports, faxes, or emails are considered preliminary.

ALS Laboratory Group has an extensive QA/QC program where all analytical data reported is analyzed using approved referenced procedures followed by checks and reviews by senior managers and quality assurance personnel. However, since the results are obtained from chemical measurements and thus cannot be guaranteed, ALS Laboratory Group assumes no liability for the use or interpretation of the results.



ALS Environmental
excellence in analytical testing

1988 Triumph Street, Vancouver, BC V5L 1K5
Tel: 604-253-4188 Toll Free: 1-800-665-0243 Fax: 604-253-6700
ALS Contact: Can Dang

Form 61725

bhpbilliton
BHP Billiton Diamonds Inc.
1102 4920 52nd Street, Yellowknife, NT X1A 3T1
Tel: 867-880-2157 Fax: 867-880-4012
BHP Contacts: David Bruce/ Richard Ehler

CHAIN OF CUSTODY FORM

Station ID	Matrix	Date	Time	Init	Dustfall Metals	Insoluble Particulate	Nitrate	Soluble Particulate	Sulphate	Total Particulate
Fox-D30-P	Dust	05-Aug-2008	02:10 PM	SH	1	1	1	1	1	BHP2
Fox-D90-M	Dust	05-Aug-2008	02:15 PM	SH	1	1	1	1	1	BHP2
Fox-D90-P	Dust	05-Aug-2008	02:15 PM	SH	1	1	1	1	1	BHP2
Fox-U30-M	Dust	05-Aug-2008	02:00 PM	SH	1	1	1	1	1	BHP2
Mis-D300-M	Dust	05-Aug-2008	11:45 AM	SH	1	1	1	1	1	BHP2
Mis-D300-P	Dust	05-Aug-2008	11:45 AM	SH	1	1	1	1	1	BHP2
Mis-D30-M	Dust	05-Aug-2008	11:25 AM	SH	1	1	1	1	1	BHP2
Mis-D30-P	Dust	05-Aug-2008	11:25 AM	SH	1	1	1	1	1	BHP2
Mis-D90-M	Dust	05-Aug-2008	11:35 AM	SH	1	1	1	1	1	BHP2
Mis-D90-P	Dust	05-Aug-2008	11:35 AM	SH	1	1	1	1	1	BHP2
Mis-U30-M	Dust	05-Aug-2008	11:15 AM	SH	1	1	1	1	1	BHP2
Mis-U30-P	Dust	05-Aug-2008	11:15 AM	SH	1	1	1	1	1	BHP2
Fox-U30-P	Dust	05-Aug-2008	02:00 PM	SH	1	1	1	1	1	BHP2
FOX-D1000-P	Dust	05-Aug-2008	03:20 PM	SH	1	1	1	1	1	BHP2
FOX-D1000-M	Dust	05-Aug-2008	03:20 PM	SH	1	1	1	1	1	BHP2
MIS-D1000-P	Dust	05-Aug-2008	03:05 PM	SH	1	1	1	1	1	BHP2
MIS-D1000-M	Dust	05-Aug-2008	03:05 PM	SH	1	1	1	1	1	BHP2
Air-P125-M	Dust	05-Aug-2008	09:05 AM	SH	1	1	1	1	1	BHP2
LLCF-PA-M	Dust	05-Aug-2008	10:10 AM	SH	1	1	1	1	1	BHP2
LLCF-PA-P	Dust	05-Aug-2008	10:10 AM	SH	1	1	1	1	1	BHP2

For Lab Use

C680683

FOR LAB USE ONLY

Turn around Required: Regular

Special Instructions (Billing details, QC reporting, etc):

Billing Code: BHP2503

Deployment: 5-Aug-08

Collection: 5-Sep-08

Relinquished by:	Date Time: 7:58:00 1315	Received by:	Date Time: Sept 19 08 12:20
Relinquished by:	Date Time:	Received by:	Date Time:

FOR LAB USE ONLY

Cooler seal intact upon receipt?	Sample temperature upon receipt:	Frozen?	Yes	No
<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	14 c.	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No		

Send Analytical Results to:

compliance.team@bhpbilliton.com;



ALS Environmental
excellence in analytical testing

1988 Triumph Street, Vancouver, BC V5L 1K5
Tel: 604-253-4188 Toll Free: 1-800-665-0243 Fax: 604-253-0700
ALS Contact: Can Dang

Form 61725



bhpbilliton
BHP Billiton Diamonds Inc.
1102 4920 52nd Street, Yellowknife, NT X1A 3T1
Tel: 867-880-2157 Fax: 867-880-4012
BHP Contacts: David Bruce/ Richard Ehler/David

CHAIN OF CUSTODY FORM

Station ID	Matrix	Date	Time	Init	Dustfall Metals	Insoluble Particulate	Nitrate	Soluble Particulate	Sulphate	Total Particulate
AQ-49-M	Dust	05-Aug-2008	03:30 PM	SH	1	1	1	1	1	BHP2
AQ-49-P	Dust	05-Aug-2008	03:30 PM	SH						BHP2
AQ-54-M	Dust	05-Aug-2008	03:45 PM	SH	1	1	1	1	1	BHP2
AQ-54-P	Dust	05-Aug-2008	03:45 PM	SH						BHP2
Fox-D300-M	Dust	05-Aug-2008	02:20 PM	SH	1	1	1	1	1	BHP2
Fox-D300-P	Dust	05-Aug-2008	02:20 PM	SH						BHP2
Fox-D30-M	Dust	05-Aug-2008	02:10 PM	SH	1	1	1	1	1	BHP2
Air-P125-P	Dust	05-Aug-2008	09:15 AM	SH	1	1	1	1	1	BHP2
Air-P162-M	Dust	05-Aug-2008	09:15 AM	SH						BHP2
Air-P162-P	Dust	05-Aug-2008	09:15 AM	SH	1	1	1	1	1	BHP2
Air-P280-M	Dust	05-Aug-2008	10:47 AM	SH						BHP2
Air-P280-P	Dust	05-Aug-2008	10:47 AM	SH	1	1	1	1	1	BHP2
LLCF-PB-M	Dust	05-Aug-2008	10:25 AM	SH	1	1	1	1	1	BHP2
LLCF-PB-P	Dust	05-Aug-2008	10:25 AM	SH						BHP2

For Lab Use

FOR LAB USE ONLY

Turn around Required: Regular

Special Instructions (Billing details, QC reporting, etc):

Billing Code: BHP2503

Deployment: 5-Aug-08

Collection: 5-Sep-08

Relinquished by:	Date Time	Received by:	Date Time
Relinquished by:	Date Time	Received by:	Date Time

FOR LAB USE ONLY

Cooler seal intact upon receipt?

☒ Yes ☐ No ☐ N/A

Sample temperature upon receipt:

Frozen? ☐ Yes ☒ No

Send Analytical Results to:

compliance.team@bhpbilliton.com;

Sept 10, 08
12:20

Appendix 5

Snow Core Chemistry Lab Analysis Data



Environmental Division

ANALYTICAL REPORT

BHP BILLITON DIAMONDS INC.

ATTN: RICHARD EHLERT

1102 - 4920 52ND STREET

YELLOWKNIFE NT X1A 3T1

Reported On: 13-MAR-08 05:04 PM

Revision: 8

Lab Work Order #: L607739

Date Received: 05-MAR-08

Project P.O. #: BHP2501

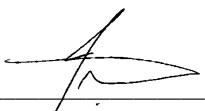
Job Reference: 10957

Legal Site Desc: 6200504479

CofC Numbers:

Other Information:

Comments: ADDITIONAL 13-MAR-08 13:26



Joyce Chow
General Manager, Vancouver

For any questions about this report please contact your Account Manager:

Can Dang

THIS REPORT SHALL NOT BE REPRODUCED EXCEPT IN FULL WITHOUT THE WRITTEN AUTHORITY OF THE LABORATORY.
ALL SAMPLES WILL BE DISPOSED OF AFTER 30 DAYS FOLLOWING ANALYSIS. PLEASE CONTACT THE LAB IF YOU
REQUIRE ADDITIONAL SAMPLE STORAGE TIME.

ALS LABORATORY GROUP ANALYTICAL REPORT

		Sample ID				
		Description				
		Sampled Date				
		Sampled Time				
		Client ID				
Grouping	Analyte					
WATER						
Physical Tests	Anion Sum (meq/L)	<0.1	<0.1			
	Cation Sum (meq/L)	<0.1	<0.1			
	Cation - Anion Balance (%)	0.0	0.0			
	Hardness (as CaCO3) (mg/L)	<0.50	<0.50			
	Conductivity (uS/cm)	<2.0	<2.0			
	pH (pH)	5.81	5.75			
	Total Dissolved Solids (mg/L)	<1.0	<1.0			
	Total Suspended Solids (mg/L)	<3.0	<3.0			
	Turbidity (NTU)	<0.10	0.28			
Anions and Nutrients	Ammonia as N (mg/L)	0.0248	0.0230			
	Alkalinity, Bicarbonate (as CaCO3) (mg/L)	<2.0	<2.0			
	Alkalinity, Carbonate (as CaCO3) (mg/L)	<2.0	<2.0			
	Alkalinity, Hydroxide (as CaCO3) (mg/L)	<2.0	<2.0			
	Alkalinity, Total (as CaCO3) (mg/L)	<2.0	<2.0			
	Chloride (Cl) (mg/L)	<0.50	<0.50			
	Fluoride (F) (mg/L)	<0.020	<0.020			
	Sulfate (SO4) (mg/L)	<0.50	<0.50			
	Nitrate and Nitrite as N (mg/L)	<0.0050	<0.0050			
	Nitrate (as N) (mg/L)	<0.0050	<0.0050			
	Nitrite (as N) (mg/L)	<0.0010	<0.0010			
	Total Kjeldahl Nitrogen (mg/L)	<0.050	0.060			
	Ortho Phosphate as P (mg/L)	<0.0010	0.0017			
	Total Phosphate as P (mg/L)	<0.0020	<0.0020			
Total Metals	Aluminum (Al)-Total (mg/L)	<0.0010	0.0025			
	Antimony (Sb)-Total (mg/L)	<0.00010	<0.00010			
	Arsenic (As)-Total (mg/L)	<0.000030	<0.000030			
	Barium (Ba)-Total (mg/L)	<0.000050	<0.000050			
	Beryllium (Be)-Total (mg/L)	<0.00020	<0.00020			
	Boron (B)-Total (mg/L)	0.0015	0.0015			
	Cadmium (Cd)-Total (mg/L)	<0.000050	<0.000050			
	Calcium (Ca)-Total (mg/L)	<0.020	<0.020			
	Chromium (Cr)-Total (mg/L)	<0.00010	<0.00010			
	Cobalt (Co)-Total (mg/L)	<0.00010	<0.00010			
	Copper (Cu)-Total (mg/L)	0.00024	0.00022			
	Iron (Fe)-Total (mg/L)	<0.010	<0.010			
	Lead (Pb)-Total (mg/L)	<0.000050	<0.000050			
	Magnesium (Mg)-Total (mg/L)	<0.0050	<0.0050			
	Manganese (Mn)-Total (mg/L)	<0.000050	<0.000050			

ALS LABORATORY GROUP ANALYTICAL REPORT

		Sample ID				
		Description				
		Sampled Date				
		Sampled Time				
		Client ID				
Grouping	Analyte					
WATER						
Total Metals	Mercury (Hg)-Total (mg/L)	<0.000020	<0.000020			
	Molybdenum (Mo)-Total (mg/L)	<0.000050	<0.000050			
	Nickel (Ni)-Total (mg/L)	0.00014	<0.00010			
	Potassium (K)-Total (mg/L)	<0.050	<0.050			
	Selenium (Se)-Total (mg/L)	<0.00010	<0.00010			
	Silicon (Si)-Total (mg/L)	0.052	0.053			
	Silver (Ag)-Total (mg/L)	<0.00010	<0.00010			
	Sodium (Na)-Total (mg/L)	<0.010	<0.010			
	Strontium (Sr)-Total (mg/L)	<0.00010	<0.00010			
	Uranium (U)-Total (mg/L)	<0.000010	<0.000010			
	Vanadium (V)-Total (mg/L)	<0.000050	<0.000050			
	Zinc (Zn)-Total (mg/L)	<0.0010	<0.0010			
Organic Parameters	Total Organic Carbon (mg/L)	<0.50	<0.50			

Reference Information

Methods Listed (if applicable):

ALS Test Code	Matrix	Test Description	Analytical Method Reference(Based On)
ALK-SCR-VA	Water	Alkalinity by colour or titration	EPA 310.2 OR APHA 2320
<p>This analysis is carried out using procedures adapted from EPA Method 310.2 "Alkalinity". Total Alkalinity is determined using the methyl orange colourimetric method.</p> <p>OR</p> <p>This analysis is carried out using procedures adapted from APHA Method 2320 "Alkalinity". Total alkalinity is determined by potentiometric titration to a pH 4.5 endpoint. Bicarbonate, carbonate and hydroxide alkalinity are calculated from phenolphthalein alkalinity and total alkalinity values.</p>			
ANIONS-CL-IC-VA	Water	Chloride by Ion Chromatography	APHA 4110 "Determination of Anions by IC
<p>This analysis is carried out using procedures adapted from APHA Method 4110 "Determination of Anions by Ion Chromatography" and EPA Method 300.0 "Determination of Inorganic Anions by Ion Chromatography". Anions routinely determined by this method include: bromide, chloride, fluoride, nitrate, nitrite and sulphate.</p>			
ANIONS-F-IC-VA	Water	Fluoride by Ion Chromatography	APHA 4110 "Determination of Anions by IC
<p>This analysis is carried out using procedures adapted from APHA Method 4110 "Determination of Anions by Ion Chromatography" and EPA Method 300.0 "Determination of Inorganic Anions by Ion Chromatography". Anions routinely determined by this method include: bromide, chloride, fluoride, nitrate, nitrite and sulphate.</p>			
ANIONS-N+N-CALC-VA	Water	Nitrite+Nitrate by Ion Chromatography	CALCULATION
<p>This analysis is carried out using procedures adapted from APHA Method 4110 "Determination of Anions by Ion Chromatography" and EPA Method 300.0 "Determination of Inorganic Anions by Ion Chromatography". Anions routinely determined by this method include: bromide, chloride, fluoride, nitrate, nitrite and sulphate.</p>			
ANIONS-NO2-IC-VA	Water	Nitrite by Ion Chromatography	APHA 4110 "Determination of Anions by IC
<p>This analysis is carried out using procedures adapted from APHA Method 4110 "Determination of Anions by Ion Chromatography" and EPA Method 300.0 "Determination of Inorganic Anions by Ion Chromatography". Anions routinely determined by this method include: bromide, chloride, fluoride, nitrate, nitrite and sulphate.</p>			
ANIONS-NO3-IC-VA	Water	Nitrate by Ion Chromatography	APHA 4110 "Determination of Anions by IC
<p>This analysis is carried out using procedures adapted from APHA Method 4110 "Determination of Anions by Ion Chromatography" and EPA Method 300.0 "Determination of Inorganic Anions by Ion Chromatography". Anions routinely determined by this method include: bromide, chloride, fluoride, nitrate, nitrite and sulphate.</p>			
ANIONS-SO4-IC-VA	Water	Sulfate by Ion Chromatography	APHA 4110 "Determination of Anions by IC
<p>This analysis is carried out using procedures adapted from APHA Method 4110 "Determination of Anions by Ion Chromatography" and EPA Method 300.0 "Determination of Inorganic Anions by Ion Chromatography". Anions routinely determined by this method include: bromide, chloride, fluoride, nitrate, nitrite and sulphate.</p>			
CARBONS-TOC-VA	Water	Total organic carbon by combustion	APHA 5310 "TOTAL ORGANIC CARBON (TOC)"
<p>This analysis is carried out using procedures adapted from APHA Method 5310 "Total Organic Carbon (TOC)".</p>			
EC-PCT-VA	Water	Conductivity (Automated)	APHA 2510 Auto. Conduc.
<p>This analysis is carried out using procedures adapted from APHA Method 2510 "Conductivity". Conductivity is determined using a conductivity electrode.</p>			
FE-TOT-LOW-ICP-VA	Water	Total Fe in Water by ICPOES	EPA SW-846 3005A/6010B
<p>This analysis is carried out using procedures adapted from "Standard Methods for the Examination of Water and Wastewater" published by the American Public Health Association, and with procedures adapted from "Test Methods for Evaluating Solid Waste" SW-846 published by the United States Environmental Protection Agency (EPA). The procedures may involve preliminary sample treatment by acid digestion, using either hotblock or microwave oven (EPA Method 3005A). Instrumental analysis is by inductively coupled plasma - optical emission spectrophotometry (EPA Method 6010B).</p>			

Reference Information

Methods Listed (if applicable):

ALS Test Code	Matrix	Test Description	Analytical Method Reference(Based On)
HARDNESS-CALC-VA	Water	Hardness	APHA 2340B
Hardness is calculated from Calcium and Magnesium concentrations, and is expressed as calcium carbonate equivalents.			
HG-TOT-LOW-CVAFS-VA	Water	Total Mercury in Water by CVAFS(Low)	EPA 245.7
This analysis is carried out using procedures adapted from "Standard Methods for the Examination of Water and Wastewater" published by the American Public Health Association, and with procedures adapted from "Test Methods for Evaluating Solid Waste" SW-846 published by the United States Environmental Protection Agency (EPA). The procedure involves a cold-oxidation of the acidified sample using bromine monochloride prior to reduction of the sample with stannous chloride. Instrumental analysis is by cold vapour atomic fluorescence spectrophotometry (EPA Method 245.7).			
IONBALANCE-VA	Water	Ion Balance Calculation	APHA 1030E
Cation Sum, Anion Sum, and Ion Balance (as % difference) are calculated based on guidance from APHA Standard Methods (1030E Checking Correctness of Analysis). Because all aqueous solutions are electrically neutral, the calculated ion balance (% difference of cations minus anions) should be near-zero.			
Cation and Anion Sums are the total meq/L concentration of major cations and anions. Dissolved species are used where available. Minor ions are included where data is present. Ion Balance is calculated as:			
Ion Balance (%) = [Cation Sum-Anion Sum] / [Cation Sum+Anion Sum]			
MET-TOT-ICP-VA	Water	Total Metals in Water by ICPOES	EPA SW-846 3005A/6010B
This analysis is carried out using procedures adapted from "Standard Methods for the Examination of Water and Wastewater" published by the American Public Health Association, and with procedures adapted from "Test Methods for Evaluating Solid Waste" SW-846 published by the United States Environmental Protection Agency (EPA). The procedures may involve preliminary sample treatment by acid digestion, using either hotblock or microwave oven (EPA Method 3005A). Instrumental analysis is by inductively coupled plasma - optical emission spectrophotometry (EPA Method 6010B).			
MET-TOT-LOW-MS-VA	Water	Total Metals in Water by ICPMS(Low)	EPA SW-846 3005A/6020A
This analysis is carried out using procedures adapted from "Standard Methods for the Examination of Water and Wastewater" published by the American Public Health Association, and with procedures adapted from "Test Methods for Evaluating Solid Waste" SW-846 published by the United States Environmental Protection Agency (EPA). The procedures may involve preliminary sample treatment by acid digestion, using either hotblock or microwave oven, or filtration (EPA Method 3005A). Instrumental analysis is by inductively coupled plasma - mass spectrometry (EPA Method 6020A).			
MET-TOT-ULTRA-MS-VA	Water	Total Metals in Water by ICPMS (Ultra)	EPA SW-846 3005A/6020A
This analysis is carried out using procedures adapted from "Standard Methods for the Examination of Water and Wastewater" published by the American Public Health Association, and with procedures adapted from "Test Methods for Evaluating Solid Waste" SW-846 published by the United States Environmental Protection Agency (EPA). The procedures may involve preliminary sample treatment by acid digestion, using either hotblock or microwave oven, or filtration (EPA Method 3005A). Instrumental analysis is by inductively coupled plasma - mass spectrometry (EPA Method 6020A).			
N-TOT-COMBUST-VA	Water	Total Nitrogen by Combustion	ASTM D5176-91, EN12260 (EU STD Method)
This analysis is carried out using procedures adapted from ASTM Method D 5176-91 "Standard Test Method for Total Chemically Bound Nitrogen in Water by Pyrolysis and Chemiluminescence detection." Total Nitrogen is determined directly by pyrolysis with chemiluminescence detection using automated instrumentation. Total Kjeldahl Nitrogen is determined by calculation.			
NH3-COL-VA	Water	Ammonia by Color	APHA 4500-NH3 "Nitrogen (Ammonia)"
This analysis is carried out, on unpreserved samples, using procedures adapted from APHA Method 4500-NH3 "Nitrogen (Ammonia)". Ammonia is determined using the phenate colourimetric method.			
PH-MAN-VA	Water	pH by Manual Meter	APHA 4500-H "pH Value"
This analysis is carried out using procedures adapted from APHA Method 4500-H "pH Value". The pH is determined in the laboratory using a pH electrode.			

Reference Information

Methods Listed (if applicable):

ALS Test Code	Matrix	Test Description	Analytical Method Reference(Based On)
---------------	--------	------------------	---------------------------------------

PO4-DO-COL-VA Water Dissolved ortho Phosphate by Color APHA 4500-P "Phosphorous"

This analysis is carried out using procedures adapted from APHA Method 4500-P "Phosphorus". All forms of phosphate are determined by the ascorbic acid colourimetric method. Dissolved ortho-phosphate (dissolved reactive phosphorous) is determined by direct measurement. Total phosphate (total phosphorous) is determined after persulphate digestion of a sample. Total dissolved phosphate (total dissolved phosphorous) is determined by filtering a sample through a 0.45 micron membrane filter followed by persulfate digestion of the filtrate.

PO4-T-COL-VA Water Total Phosphate P by Color APHA 4500-P "Phosphorous"

This analysis is carried out using procedures adapted from APHA Method 4500-P "Phosphorus". All forms of phosphate are determined by the ascorbic acid colourimetric method. Dissolved ortho-phosphate (dissolved reactive phosphorous) is determined by direct measurement. Total phosphate (total phosphorous) is determined after persulphate digestion of a sample. Total dissolved phosphate (total dissolved phosphorous) is determined by filtering a sample through a 0.45 micron membrane filter followed by persulfate digestion of the filtrate.

TDS-CALC-VA Water TDS (Calculation from EC) APHA 1030E (20TH EDITION)

This analysis is carried out using procedures adapted from APHA 1030E "Checking Correctness of Analyses".

TKN-CALC-VA Water TKN by Calculation via TN combustion BC MOE LABORATORY MANUAL (2005)

This analysis is carried out using procedures adapted from ASTM Method D 5176-91 "Standard Test Method for Total Chemically Bound Nitrogen in Water by Pyrolysis and Chemiluminescence detection." Total Nitrogen is determined directly by pyrolysis with chemiluminescence detection using automated instrumentation. Total Kjeldahl Nitrogen is determined by calculation.

TSS-VA Water Solids by Gravimetric APHA 2540 Gravimetric

This analysis is carried out using procedures adapted from APHA Method 2540 "Solids". Solids are determined gravimetrically. Total suspended solids (TSS) are determined by filtering a sample through a glass fibre filter, TSS is determined by drying the filter at 104 degrees celsius.

TURBIDITY-VA Water Turbidity by Meter APHA 2130 "Turbidity"

This analysis is carried out using procedures adapted from APHA Method 2130 "Turbidity". Turbidity is determined by the nephelometric method.

**** Laboratory Methods employed follow in-house procedures, which are generally based on nationally or internationally accepted methodologies.**

The last two letters of the above ALS Test Code column indicate the laboratory that performed analytical analysis for that test. Refer to the list below:

Laboratory Definition Code	Laboratory Location	Laboratory Definition Code	Laboratory Location
VA	ALS LABORATORY GROUP - VANCOUVER, BC, CANADA		

GLOSSARY OF REPORT TERMS

Surr - A surrogate is an organic compound that is similar to the target analyte(s) in chemical composition and behavior but not normally detected in environmental samples. Prior to sample processing, samples are fortified with one or more surrogate compounds.

The reported surrogate recovery value provides a measure of method efficiency.

mg/kg (units) - unit of concentration based on mass, parts per million

mg/L (units) - unit of concentration based on volume, parts per million

N/A - Result not available. Refer to qualifier code and definition for explanation

Test results reported relate only to the samples as received by the laboratory.

UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.

Although test results are generated under strict QA/QC protocols, any unsigned test reports, faxes, or emails are considered preliminary.

ALS Laboratory Group has an extensive QA/QC program where all analytical data reported is analyzed using approved referenced procedures followed by checks and reviews by senior managers and quality assurance personnel. However, since the results are obtained from chemical measurements and thus cannot be guaranteed, ALS Laboratory Group assumes no liability for the use or interpretation of the results.



CHAIN OF CUSTODY FORM

RUSH
Requires priority processing

L607739

For Lab Use

Station ID	Matrix	Date	Time	Init	AEMP-Major Ions	AEMP-Metals ICP-MS Low	AEMP-Nutrients	Alkalinity Species	IC Scan	Ortho-Phosphate	Total Organic Carbon	Total Silicon								
AQ-Blank	Snow	3/3/2008	2:30:00 PM	JS	1	1	1	1	1	1	1	1	BHP2							
AQ-TEST	Snow	3/2/2008	2:30:00 PM	JS	1	1	1	1	1	1	1	1	BHP2							

FOR LAB USE ONLY

Turn around Required: ASAP

Special Instructions (Billing details, QC reporting, etc):

Billing Code: BHP2501

Please Rush

Relinquished by:

Date

Time

Received by:

Reg B

Date

Time

Mar 5 14:34

Relinquished by:

Date

Time

Received by:

Date

Time

FOR LAB USE ONLY

Cooler seal intact upon receipt?

☒ Yes ☐ No ☐ N/A

Sample temperature upon receipt: 14 c.

Frozen? ☐ Yes ☒ No

Send Analytical Results to:

compliance.team@bhpbilliton.com



Environmental Division

ANALYTICAL REPORT

BHP BILLITON DIAMONDS INC.

ATTN: RICHARD EHLERT

1102 - 4920 52ND STREET

YELLOWKNIFE NT X1A 3T1

Reported On: 06-MAY-08 07:04 PM

Revision: 1

Lab Work Order #: L621684

Date Received: 22-APR-08

Project P.O. #: BHP2501

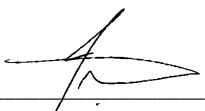
Job Reference: 10970

Legal Site Desc: 6200504479

CofC Numbers:

Other Information:

Comments:



Joyce Chow
General Manager, Vancouver

For any questions about this report please contact your Account Manager:

Can Dang

THIS REPORT SHALL NOT BE REPRODUCED EXCEPT IN FULL WITHOUT THE WRITTEN AUTHORITY OF THE LABORATORY.
ALL SAMPLES WILL BE DISPOSED OF AFTER 30 DAYS FOLLOWING ANALYSIS. PLEASE CONTACT THE LAB IF YOU
REQUIRE ADDITIONAL SAMPLE STORAGE TIME.

ALS LABORATORY GROUP ANALYTICAL REPORT

		Sample ID	L621684-1	L621684-2	L621684-3	L621684-4	
		Description					
		Sampled Date	14-APR-08	14-APR-08	14-APR-08	14-APR-08	
		Sampled Time	11:42	14:19	16:31	15:49	
		Client ID	AQ-55	AQ-54	AQ-49	AQ-115	
Grouping	Analyte						
WATER							
Physical Tests	Anion Sum (meq/L)	<0.1	<0.1	<0.1	<0.1		
	Cation Sum (meq/L)	<0.1	<0.1	<0.1	<0.1		
	Cation - Anion Balance (%)	86.8	45.9	85.2	87.2		
	Hardness (as CaCO3) (mg/L)	0.93	0.82	2.35	1.59		
	Conductivity (uS/cm)	<2.0	3.3	2.0	<2.0		
	pH (pH)	5.50	5.30	5.70	5.48		
	Total Dissolved Solids (mg/L)	2.4	2.6	2.5	3.4		
	Total Suspended Solids (mg/L)	7.2	5.9	8.6	23.2		
	Turbidity (NTU)	5.56	3.74	7.36	6.86		
Anions and Nutrients	Ammonia as N (mg/L)	0.0117	<0.0050	0.0350	0.0595		
	Alkalinity, Bicarbonate (as CaCO3) (mg/L)	<2.0	<2.0	<2.0	<2.0		
	Alkalinity, Carbonate (as CaCO3) (mg/L)	<2.0	<2.0	<2.0	<2.0		
	Alkalinity, Hydroxide (as CaCO3) (mg/L)	<2.0	<2.0	<2.0	<2.0		
	Alkalinity, Total (as CaCO3) (mg/L)	<2.0	<2.0	<2.0	<2.0		
	Chloride (Cl) (mg/L)	<0.50	<0.50	<0.50	<0.50		
	Fluoride (F) (mg/L)	<0.020	<0.020	<0.020	<0.020		
	Sulfate (SO4) (mg/L)	<0.50	0.53	<0.50	<0.50		
	Nitrate (as N) (mg/L)	0.0742	0.0660	0.0969	0.0665		
	Nitrite (as N) (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010		
	Total Kjeldahl Nitrogen (mg/L)	0.066	<0.050	<0.050	<0.050		
	Ortho Phosphate as P (mg/L)	<0.0010	<0.0010	0.0033	0.0015		
	Total Phosphate as P (mg/L)	0.0091	0.0085	0.0107	0.0021		
Total Metals	Aluminum (Al)-Total (mg/L)	0.309	0.107	0.166	0.123		
	Antimony (Sb)-Total (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010		
	Arsenic (As)-Total (mg/L)	0.000034	<0.000030	0.000067	0.000047		
	Barium (Ba)-Total (mg/L)	0.00276	0.00257	0.00677	0.00515		
	Beryllium (Be)-Total (mg/L)	<0.00020	<0.00020	<0.00020	<0.00020		
	Boron (B)-Total (mg/L)	0.0010	<0.0010	<0.0010	<0.0010		
	Cadmium (Cd)-Total (mg/L)	0.000099	<0.000050	<0.000050	0.000057		
	Calcium (Ca)-Total (mg/L)	0.143	0.127	0.279	0.228		
	Chromium (Cr)-Total (mg/L)	0.00071	0.00059	0.00124	0.00075		
	Cobalt (Co)-Total (mg/L)	0.00011	<0.00010	0.00025	0.00015		
	Copper (Cu)-Total (mg/L)	0.00295	0.00108	0.00136	0.00154		
	Iron (Fe)-Total (mg/L)	0.102	0.083	0.183	0.121		
	Lead (Pb)-Total (mg/L)	0.000592	0.000355	0.000500	0.000393		
	Magnesium (Mg)-Total (mg/L)	0.139	0.122	0.402	0.249		
	Manganese (Mn)-Total (mg/L)	0.00357	0.00344	0.00484	0.00927		
	Mercury (Hg)-Total (mg/L)	<0.000020	<0.000020	<0.000020	<0.000020		

ALS LABORATORY GROUP ANALYTICAL REPORT

		Sample ID	L621684-1	L621684-2	L621684-3	L621684-4	
		Description					
		Sampled Date	14-APR-08	14-APR-08	14-APR-08	14-APR-08	
		Sampled Time	11:42	14:19	16:31	15:49	
		Client ID	AQ-55	AQ-54	AQ-49	AQ-115	
Grouping	Analyte						
WATER							
Total Metals	Molybdenum (Mo)-Total (mg/L)	0.0739	0.0191	0.0123	0.0127		
	Nickel (Ni)-Total (mg/L)	0.00515	0.00140	0.00403	0.00209		
	Potassium (K)-Total (mg/L)	0.107	0.098	0.124	0.322		
	Selenium (Se)-Total (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010		
	Silicon (Si)-Total (mg/L)	0.138	0.183	0.369	0.255		
	Silver (Ag)-Total (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010		
	Sodium (Na)-Total (mg/L)	0.227	0.072	0.133	0.070		
	Strontium (Sr)-Total (mg/L)	0.00092	0.00088	0.00310	0.00164		
	Uranium (U)-Total (mg/L)	0.000010	0.000010	0.000035	0.000017		
	Vanadium (V)-Total (mg/L)	0.000199	0.000189	0.000410	0.000260		
	Zinc (Zn)-Total (mg/L)	0.0522	0.0195	0.0190	0.0165		
Organic Parameters	Total Organic Carbon (mg/L)	1.07	1.19	0.80	2.00		

Reference Information

Methods Listed (if applicable):

ALS Test Code	Matrix	Test Description	Analytical Method Reference(Based On)
ALK-SCR-VA	Water	Alkalinity by colour or titration	EPA 310.2 OR APHA 2320
<p>This analysis is carried out using procedures adapted from EPA Method 310.2 "Alkalinity". Total Alkalinity is determined using the methyl orange colourimetric method.</p> <p>OR</p> <p>This analysis is carried out using procedures adapted from APHA Method 2320 "Alkalinity". Total alkalinity is determined by potentiometric titration to a pH 4.5 endpoint. Bicarbonate, carbonate and hydroxide alkalinity are calculated from phenolphthalein alkalinity and total alkalinity values.</p>			
ANIONS-CL-IC-VA	Water	Chloride by Ion Chromatography	APHA 4110 "Determination of Anions by IC
<p>This analysis is carried out using procedures adapted from APHA Method 4110 "Determination of Anions by Ion Chromatography" and EPA Method 300.0 "Determination of Inorganic Anions by Ion Chromatography". Anions routinely determined by this method include: bromide, chloride, fluoride, nitrate, nitrite and sulphate.</p>			
ANIONS-NO2-IC-VA	Water	Nitrite by Ion Chromatography	APHA 4110 "Determination of Anions by IC
<p>This analysis is carried out using procedures adapted from APHA Method 4110 "Determination of Anions by Ion Chromatography" and EPA Method 300.0 "Determination of Inorganic Anions by Ion Chromatography". Anions routinely determined by this method include: bromide, chloride, fluoride, nitrate, nitrite and sulphate.</p>			
ANIONS-NO3-IC-VA	Water	Nitrate by Ion Chromatography	APHA 4110 "Determination of Anions by IC
<p>This analysis is carried out using procedures adapted from APHA Method 4110 "Determination of Anions by Ion Chromatography" and EPA Method 300.0 "Determination of Inorganic Anions by Ion Chromatography". Anions routinely determined by this method include: bromide, chloride, fluoride, nitrate, nitrite and sulphate.</p>			
ANIONS-SO4-IC-VA	Water	Sulfate by Ion Chromatography	APHA 4110 "Determination of Anions by IC
<p>This analysis is carried out using procedures adapted from APHA Method 4110 "Determination of Anions by Ion Chromatography" and EPA Method 300.0 "Determination of Inorganic Anions by Ion Chromatography". Anions routinely determined by this method include: bromide, chloride, fluoride, nitrate, nitrite and sulphate.</p>			
CARBONS-TOC-VA	Water	Total organic carbon by combustion	APHA 5310 "TOTAL ORGANIC CARBON (TOC)"
<p>This analysis is carried out using procedures adapted from APHA Method 5310 "Total Organic Carbon (TOC)".</p>			
EC-PCT-VA	Water	Conductivity (Automated)	APHA 2510 Auto. Conduc.
<p>This analysis is carried out using procedures adapted from APHA Method 2510 "Conductivity". Conductivity is determined using a conductivity electrode.</p>			
F-SIE-VA	Water	Fluoride by SIE	APHA 4500-F "Fluoride"
<p>This analysis is carried out using procedures adapted from APHA Method 4500-F "Fluoride". Fluoride is determined using a selective ion electrode.</p>			
FE-TOT-LOW-ICP-VA	Water	Total Fe in Water by ICPOES	EPA SW-846 3005A/6010B
<p>This analysis is carried out using procedures adapted from "Standard Methods for the Examination of Water and Wastewater" published by the American Public Health Association, and with procedures adapted from "Test Methods for Evaluating Solid Waste" SW-846 published by the United States Environmental Protection Agency (EPA). The procedures may involve preliminary sample treatment by acid digestion, using either hotblock or microwave oven (EPA Method 3005A). Instrumental analysis is by inductively coupled plasma - optical emission spectrophotometry (EPA Method 6010B).</p>			
HARDNESS-CALC-VA	Water	Hardness	APHA 2340B
<p>Hardness is calculated from Calcium and Magnesium concentrations, and is expressed as calcium carbonate equivalents.</p>			
HG-TOT-LOW-CVAFS-VA	Water	Total Mercury in Water by CVAFS(Low)	EPA 245.7
<p>This analysis is carried out using procedures adapted from "Standard Methods for the Examination of Water and Wastewater" published by the American Public Health Association, and with procedures adapted from "Test Methods for Evaluating Solid Waste" SW-846 published by the United States Environmental Protection Agency (EPA). The procedure involves a cold-oxidation of the acidified sample using bromine monochloride prior to reduction of the sample with stannous chloride. Instrumental analysis is by cold vapour atomic fluorescence spectrophotometry (EPA Method 245.7).</p>			

Reference Information

Methods Listed (if applicable):

ALS Test Code	Matrix	Test Description	Analytical Method Reference(Based On)
IONBALANCE-VA			
	Water	Ion Balance Calculation	APHA 1030E
Cation Sum, Anion Sum, and Ion Balance (as % difference) are calculated based on guidance from APHA Standard Methods (1030E Checking Correctness of Analysis). Because all aqueous solutions are electrically neutral, the calculated ion balance (% difference of cations minus anions) should be near-zero.			
Cation and Anion Sums are the total meq/L concentration of major cations and anions. Dissolved species are used where available. Minor ions are included where data is present. Ion Balance is calculated as:			
Ion Balance (%) = [Cation Sum-Anion Sum] / [Cation Sum+Anion Sum]			
MET-TOT-ICP-VA			
	Water	Total Metals in Water by ICPOES	EPA SW-846 3005A/6010B
This analysis is carried out using procedures adapted from "Standard Methods for the Examination of Water and Wastewater" published by the American Public Health Association, and with procedures adapted from "Test Methods for Evaluating Solid Waste" SW-846 published by the United States Environmental Protection Agency (EPA). The procedures may involve preliminary sample treatment by acid digestion, using either hotblock or microwave oven (EPA Method 3005A). Instrumental analysis is by inductively coupled plasma - optical emission spectrophotometry (EPA Method 6010B).			
MET-TOT-LOW-MS-VA			
	Water	Total Metals in Water by ICPMS(Low)	EPA SW-846 3005A/6020A
This analysis is carried out using procedures adapted from "Standard Methods for the Examination of Water and Wastewater" published by the American Public Health Association, and with procedures adapted from "Test Methods for Evaluating Solid Waste" SW-846 published by the United States Environmental Protection Agency (EPA). The procedures may involve preliminary sample treatment by acid digestion, using either hotblock or microwave oven, or filtration (EPA Method 3005A). Instrumental analysis is by inductively coupled plasma - mass spectrometry (EPA Method 6020A).			
MET-TOT-ULTRA-MS-VA			
	Water	Total Metals in Water by ICPMS (Ultra)	EPA SW-846 3005A/6020A
This analysis is carried out using procedures adapted from "Standard Methods for the Examination of Water and Wastewater" published by the American Public Health Association, and with procedures adapted from "Test Methods for Evaluating Solid Waste" SW-846 published by the United States Environmental Protection Agency (EPA). The procedures may involve preliminary sample treatment by acid digestion, using either hotblock or microwave oven, or filtration (EPA Method 3005A). Instrumental analysis is by inductively coupled plasma - mass spectrometry (EPA Method 6020A).			
N-TOT-COMBUST-VA			
	Water	Total Nitrogen by Combustion	ASTM D5176-91, EN12260 (EU STD Method)
This analysis is carried out using procedures adapted from ASTM Method D 5176-91 "Standard Test Method for Total Chemically Bound Nitrogen in Water by Pyrolysis and Chemiluminescence detection." Total Nitrogen is determined directly by pyrolysis with chemiluminescence detection using automated instrumentation. Total Kjeldahl Nitrogen is determined by calculation.			
NH3-COL-VA			
	Water	Ammonia by Color	APHA 4500-NH3 "Nitrogen (Ammonia)"
This analysis is carried out, on unpreserved samples, using procedures adapted from APHA Method 4500-NH3 "Nitrogen (Ammonia)". Ammonia is determined using the phenate colourimetric method.			
PH-MAN-VA			
	Water	pH by Manual Meter	APHA 4500-H "pH Value"
This analysis is carried out using procedures adapted from APHA Method 4500-H "pH Value". The pH is determined in the laboratory using a pH electrode.			
PO4-DO-COL-VA			
	Water	Dissolved ortho Phosphate by Color	APHA 4500-P "Phosphorous"
This analysis is carried out using procedures adapted from APHA Method 4500-P "Phosphorus". All forms of phosphate are determined by the ascorbic acid colourimetric method. Dissolved ortho-phosphate (dissolved reactive phosphorous) is determined by direct measurement. Total phosphate (total phosphorous) is determined after persulphate digestion of a sample. Total dissolved phosphate (total dissolved phosphorous) is determined by filtering a sample through a 0.45 micron membrane filter followed by persulfate digestion of the filtrate.			
PO4-T-COL-VA			
	Water	Total Phosphate P by Color	APHA 4500-P "Phosphorous"
This analysis is carried out using procedures adapted from APHA Method 4500-P "Phosphorus". All forms of phosphate are determined by the ascorbic acid colourimetric method. Dissolved ortho-phosphate (dissolved reactive phosphorous) is determined by direct measurement. Total phosphate (total phosphorous) is determined after persulphate digestion of a sample. Total dissolved phosphate (total dissolved phosphorous) is determined by filtering a sample through a 0.45 micron membrane filter followed by persulfate digestion of the filtrate.			

Reference Information

Methods Listed (if applicable):

ALS Test Code	Matrix	Test Description	Analytical Method Reference(Based On)
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TDS-CALC-VA Water TDS (Calculation from EC) APHA 1030E (20TH EDITION)

This analysis is carried out using procedures adapted from APHA 1030E "Checking Correctness of Analyses".

TKN-CALC-VA Water TKN by Calculation via TN combustion BC MOE LABORATORY MANUAL (2005)

This analysis is carried out using procedures adapted from ASTM Method D 5176-91 "Standard Test Method for Total Chemically Bound Nitrogen in Water by Pyrolysis and Chemiluminescence detection." Total Nitrogen is determined directly by pyrolysis with chemiluminescence detection using automated instrumentation. Total Kjeldahl Nitrogen is determined by calculation.

TSS-VA Water Solids by Gravimetric APHA 2540 Gravimetric

This analysis is carried out using procedures adapted from APHA Method 2540 "Solids". Solids are determined gravimetrically. Total suspended solids (TSS) are determined by filtering a sample through a glass fibre filter, TSS is determined by drying the filter at 104 degrees celsius.

TURBIDITY-VA Water Turbidity by Meter APHA 2130 "Turbidity"

This analysis is carried out using procedures adapted from APHA Method 2130 "Turbidity". Turbidity is determined by the nephelometric method.

**** Laboratory Methods employed follow in-house procedures, which are generally based on nationally or internationally accepted methodologies.**

The last two letters of the above ALS Test Code column indicate the laboratory that performed analytical analysis for that test. Refer to the list below:

Laboratory Definition Code	Laboratory Location	Laboratory Definition Code	Laboratory Location
VA	ALS LABORATORY GROUP - VANCOUVER, BC, CANADA		

GLOSSARY OF REPORT TERMS

Surr - A surrogate is an organic compound that is similar to the target analyte(s) in chemical composition and behavior but not normally detected in environmental samples. Prior to sample processing, samples are fortified with one or more surrogate compounds.

The reported surrogate recovery value provides a measure of method efficiency.

mg/kg (units) - unit of concentration based on mass, parts per million

mg/L (units) - unit of concentration based on volume, parts per million

N/A - Result not available. Refer to qualifier code and definition for explanation

Test results reported relate only to the samples as received by the laboratory.

UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.

Although test results are generated under strict QA/QC protocols, any unsigned test reports, faxes, or emails are considered preliminary.

ALS Laboratory Group has an extensive QA/QC program where all analytical data reported is analyzed using approved referenced procedures followed by checks and reviews by senior managers and quality assurance personnel. However, since the results are obtained from chemical measurements and thus cannot be guaranteed, ALS Laboratory Group assumes no liability for the use or interpretation of the results.



ALS Contact: Can Dang

bhpbilliton

BHP Contacts: Sarah Baines / Richard Ehlert

CHAIN OF CUSTODY FORM

[illegible]

~~U621679~~ U621684

For Lab Use

Station ID	Matrix	Date	Time	Init	Init	1	2	3	4
AQ-55	Snow	4/16/2008	11:42:00 A	W	1	1	1	1	BHP2
AQ-54	Snow	4/16/2008	2:19:00 PM	W	1	1	1	1	BHP2
AQ-49	Snow	4/16/2008	4:31:00 PM	W	1	1	1	1	BHP2
AQ-115	Snow	4/16/2008	3:49:00 PM	W	1	1	1	1	BHP2

FOR LAB USE ONLY

Turn around Required: Regular

Special Instructions (Billing details, QC reporting, etc):

Billing Code: BHP2501

Usual two-week turnaround

Relinquished by:

Date _____

Time

Received by:

Received by:
ZK

Date 4/22/08

Time 14:3

Relinquished by:

Date _____

Time

Received by:

Date _____

Time

FOR LAB USE ONLY

Cooler seal intact upon receipt?

☒ Yes ☐ No ☐ N/A

Sample temperature upon receipt:

Frozen? ☐ Yes ☒ No

Send Analytical Results to:

compliance.team@bhpbilliton.com



Environmental Division

ANALYTICAL REPORT

BHP BILLITON DIAMONDS INC.

ATTN: RICHARD EHLERT

1102 - 4920 52ND STREET

YELLOWKNIFE NT X1A 3T1

Reported On: 12-MAY-08 12:51 PM

Revision: 2

Lab Work Order #: L620149

Date Received: 16-APR-08

Project P.O. #: BHP2501

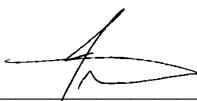
Job Reference: 10969

Legal Site Desc: 6200504479

CofC Numbers: 10969

Other Information:

Comments: Revision 2: EXtra total Potassium data was removed from all samples.



Joyce Chow
General Manager, Vancouver

For any questions about this report please contact your Account Manager:

Can Dang

THIS REPORT SHALL NOT BE REPRODUCED EXCEPT IN FULL WITHOUT THE WRITTEN AUTHORITY OF THE LABORATORY.
ALL SAMPLES WILL BE DISPOSED OF AFTER 30 DAYS FOLLOWING ANALYSIS. PLEASE CONTACT THE LAB IF YOU
REQUIRE ADDITIONAL SAMPLE STORAGE TIME.

ALS LABORATORY GROUP ANALYTICAL REPORT

		Sample ID	L620149-1	L620149-2	L620149-3	L620149-4	L620149-5
		Description					
		Sampled Date	11-APR-08	11-APR-08	11-APR-08	11-APR-08	09-APR-08
		Sampled Time	15:30	14:20	15:15	16:15	15:00
		Client ID	AQ-C4, F1	AQ-101	AQ-C4	AQ-43	AQ-32
Grouping	Analyte						
WATER							
Physical Tests	Anion Sum (meq/L)	<0.1	<0.1	<0.1	<0.1	<0.1	
	Cation Sum (meq/L)	<0.1	<0.1	<0.1	<0.1	<0.1	
	Cation - Anion Balance (%)	0.0	98.7	0.0	84.9	69.8	
	Hardness (as CaCO3) (mg/L)	1.26	1.18	1.15	<0.50	<0.50	
	Conductivity (uS/cm)	3.7	3.1	4.3	3.1	4.0	
	pH (pH)	5.46	5.58	5.27	5.34	5.14	
	Total Dissolved Solids (mg/L)	4.7	4.9	4.2	3.0	1.2	
	Total Suspended Solids (mg/L)	5.9	7.2	15.9	3.2	<3.0	
	Turbidity (NTU)	2.19	5.83	3.94	2.05	2.45	
Anions and Nutrients	Ammonia as N (mg/L)	<0.0050	<0.0050	<0.0050	<0.0050	0.0193	
	Alkalinity, Bicarbonate (as CaCO3) (mg/L)	<2.0	<2.0	<2.0	<2.0	<2.0	
	Alkalinity, Carbonate (as CaCO3) (mg/L)	<2.0	<2.0	<2.0	<2.0	<2.0	
	Alkalinity, Hydroxide (as CaCO3) (mg/L)	<2.0	<2.0	<2.0	<2.0	<2.0	
	Alkalinity, Total (as CaCO3) (mg/L)	<2.0	<2.0	<2.0	<2.0	<2.0	
	Chloride (Cl) (mg/L)	<0.50	<0.50	<0.50	<0.50	<0.50	
	Fluoride (F) (mg/L)	<0.020	<0.020	<0.020	<0.020	<0.020	
	Sulfate (SO4) (mg/L)	<0.50	<0.50	<0.50	<0.50	<0.50	
	Nitrate (as N) (mg/L)	<0.0050	0.0065	<0.0050	0.0256	0.0777	
	Nitrite (as N) (mg/L)	<0.0010	<0.0010	<0.0010	0.0023	<0.0010	
	Total Kjeldahl Nitrogen (mg/L)	0.110	0.054	0.110	0.072	<0.050	
	Ortho Phosphate as P (mg/L)	<0.0010	0.0334	0.0089	0.0056	0.0011	
	Total Phosphate as P (mg/L)	0.0194	0.0510	0.0337	0.0145	0.0021	
Total Metals	Aluminum (Al)-Total (mg/L)	0.0882	0.283	0.142	0.0515	0.0867	
	Antimony (Sb)-Total (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	
	Arsenic (As)-Total (mg/L)	0.000032	0.000038	0.000043	<0.000030	<0.000030	
	Barium (Ba)-Total (mg/L)	0.00308	0.00250	0.00356	0.00123	0.00114	
	Beryllium (Be)-Total (mg/L)	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	
	Boron (B)-Total (mg/L)	<0.0010	<0.0010	0.0012	<0.0010	<0.0010	
	Cadmium (Cd)-Total (mg/L)	<0.000050	0.000072	<0.000050	<0.000050	<0.000050	
	Calcium (Ca)-Total (mg/L)	0.310	0.137	0.258	<0.10	0.064	
	Chromium (Cr)-Total (mg/L)	0.00027	0.00080	0.00028	0.00024	0.00034	
	Cobalt (Co)-Total (mg/L)	0.00014	0.00011	0.00011	<0.00010	<0.00010	
	Copper (Cu)-Total (mg/L)	<0.0010	0.00403	0.00140	0.00056	<0.00060	
	Iron (Fe)-Total (mg/L)	0.057	0.108	0.085	0.025	0.031	
	Lead (Pb)-Total (mg/L)	0.000309	0.000477	0.000331	0.000301	0.00100	
	Magnesium (Mg)-Total (mg/L)	0.117	0.205	0.121	0.0741	0.0443	
	Manganese (Mn)-Total (mg/L)	0.0200	0.0144	0.0170	0.00713	0.00129	
	Mercury (Hg)-Total (mg/L)	<0.000020	<0.000020	<0.000020	<0.000020	<0.000020	

ALS LABORATORY GROUP ANALYTICAL REPORT

		Sample ID				
		Description				
		Sampled Date				
		Sampled Time				
		Client ID				
Grouping	Analyte					
WATER						
Physical Tests	Anion Sum (meq/L)	0.1	<0.1			
	Cation Sum (meq/L)	1.9	0.2			
	Cation - Anion Balance (%)	86.9	94.0			
	Hardness (as CaCO3) (mg/L)	63.7	4.82			
	Conductivity (uS/cm)	16.9	<2.0			
	pH (pH)	6.58	6.04			
	Total Dissolved Solids (mg/L)	35.7	3.9			
	Total Suspended Solids (mg/L)	101	15.2			
	Turbidity (NTU)	41.4	9.48			
Anions and Nutrients	Ammonia as N (mg/L)	<0.0050	0.0168			
	Alkalinity, Bicarbonate (as CaCO3) (mg/L)	5.4	<2.0			
	Alkalinity, Carbonate (as CaCO3) (mg/L)	<2.0	<2.0			
	Alkalinity, Hydroxide (as CaCO3) (mg/L)	<2.0	<2.0			
	Alkalinity, Total (as CaCO3) (mg/L)	5.4	<2.0			
	Chloride (Cl) (mg/L)	<0.50	<0.50			
	Fluoride (F) (mg/L)	<0.020	<0.020			
	Sulfate (SO4) (mg/L)	0.84	<0.50			
	Nitrate (as N) (mg/L)	0.0948	0.0798			
	Nitrite (as N) (mg/L)	0.0016	<0.0010			
	Total Kjeldahl Nitrogen (mg/L)	0.064	<0.050			
	Ortho Phosphate as P (mg/L)	0.0090	0.0016			
	Total Phosphate as P (mg/L)	0.121	0.0157			
Total Metals	Aluminum (Al)-Total (mg/L)	3.04	0.469			
	Antimony (Sb)-Total (mg/L)	0.00012	<0.00010			
	Arsenic (As)-Total (mg/L)	0.000510	0.000060			
	Barium (Ba)-Total (mg/L)	0.128	0.0128			
	Beryllium (Be)-Total (mg/L)	<0.00020	<0.00020			
	Boron (B)-Total (mg/L)	0.0030	<0.0010			
	Cadmium (Cd)-Total (mg/L)	0.000206	<0.000050			
	Calcium (Ca)-Total (mg/L)	3.44	0.408			
	Chromium (Cr)-Total (mg/L)	0.0308	0.00270			
	Cobalt (Co)-Total (mg/L)	0.00721	0.00054			
	Copper (Cu)-Total (mg/L)	0.00873	0.00259			
	Iron (Fe)-Total (mg/L)	5.51	0.511			
	Lead (Pb)-Total (mg/L)	0.00195	0.000523			
	Magnesium (Mg)-Total (mg/L)	13.4	0.924			
	Manganese (Mn)-Total (mg/L)	0.112	0.0114			
	Mercury (Hg)-Total (mg/L)	<0.000020	<0.000020			

ALS LABORATORY GROUP ANALYTICAL REPORT

		Sample ID	L620149-1	L620149-2	L620149-3	L620149-4	L620149-5
		Description					
		Sampled Date	11-APR-08	11-APR-08	11-APR-08	11-APR-08	09-APR-08
		Sampled Time	15:30	14:20	15:15	16:15	15:00
		Client ID	AQ-C4, F1	AQ-101	AQ-C4	AQ-43	AQ-32
Grouping	Analyte						
WATER							
Total Metals	Molybdenum (Mo)-Total (mg/L)		0.0172	0.0466	0.0203	0.0135	0.0137
	Nickel (Ni)-Total (mg/L)		0.00056	0.00477	0.00104	0.00039	0.00061
	Potassium (K)-Total (mg/L)		0.163	0.197	0.363	0.104	<0.050
	Selenium (Se)-Total (mg/L)		<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Silicon (Si)-Total (mg/L)		0.076	0.146	0.079	0.058	<0.050
	Silver (Ag)-Total (mg/L)		<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Sodium (Na)-Total (mg/L)		0.066	0.078	0.094	0.094	0.108
	Strontium (Sr)-Total (mg/L)		0.00117	0.00086	0.00204	0.00048	0.00042
	Uranium (U)-Total (mg/L)		0.000015	0.000010	0.000023	<0.000010	<0.000010
	Vanadium (V)-Total (mg/L)		0.000130	0.000214	0.000125	0.000118	0.000087
	Zinc (Zn)-Total (mg/L)		<0.0080	0.0320	0.0165	<0.0070	0.0089
Organic Parameters	Total Organic Carbon (mg/L)		3.85	3.80	3.52	2.58	0.55

ALS LABORATORY GROUP ANALYTICAL REPORT

		Sample ID Description Sampled Date Sampled Time Client ID	L620149-6 09-APR-08 17:45 AQ-29	L620149-7 AQ-19			
Grouping	Analyte						
WATER							
Total Metals	Molybdenum (Mo)-Total (mg/L)	0.103	0.0265				
	Nickel (Ni)-Total (mg/L)	0.114	0.00842				
	Potassium (K)-Total (mg/L)	2.07	0.235				
	Selenium (Se)-Total (mg/L)	0.00018	<0.00010				
	Silicon (Si)-Total (mg/L)	16.8	1.14				
	Silver (Ag)-Total (mg/L)	<0.00010	<0.00010				
	Sodium (Na)-Total (mg/L)	0.463	0.145				
	Strontium (Sr)-Total (mg/L)	0.0512	0.00514				
	Uranium (U)-Total (mg/L)	0.000385	0.000053				
	Vanadium (V)-Total (mg/L)	0.00910	0.00100				
	Zinc (Zn)-Total (mg/L)	0.0332	0.0403				
Organic Parameters	Total Organic Carbon (mg/L)	3.20	0.88				

Reference Information

Qualifiers for Sample Submission Listed:

Qualifier	Description
ISCR:ST	Improper Sample Container Received: Subsamples Taken - all samples:125 ml glass amber, 250 ml total metals

Methods Listed (if applicable):

ALS Test Code	Matrix	Test Description	Analytical Method Reference(Based On)
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ALK-SCR-VA Water Alkalinity by colour or titration EPA 310.2 OR APHA 2320

This analysis is carried out using procedures adapted from EPA Method 310.2 "Alkalinity". Total Alkalinity is determined using the methyl orange colourimetric method.

OR

This analysis is carried out using procedures adapted from APHA Method 2320 "Alkalinity". Total alkalinity is determined by potentiometric titration to a pH 4.5 endpoint. Bicarbonate, carbonate and hydroxide alkalinity are calculated from phenolphthalein alkalinity and total alkalinity values.

ANIONS-CL-IC-VA Water Chloride by Ion Chromatography APHA 4110 "Determination of Anions by IC

This analysis is carried out using procedures adapted from APHA Method 4110 "Determination of Anions by Ion Chromatography" and EPA Method 300.0 "Determination of Inorganic Anions by Ion Chromatography". Anions routinely determined by this method include: bromide, chloride, fluoride, nitrate, nitrite and sulphate.

ANIONS-F-IC-VA Water Fluoride by Ion Chromatography APHA 4110 "Determination of Anions by IC

This analysis is carried out using procedures adapted from APHA Method 4110 "Determination of Anions by Ion Chromatography" and EPA Method 300.0 "Determination of Inorganic Anions by Ion Chromatography". Anions routinely determined by this method include: bromide, chloride, fluoride, nitrate, nitrite and sulphate.

ANIONS-NO2-IC-VA Water Nitrite by Ion Chromatography APHA 4110 "Determination of Anions by IC

This analysis is carried out using procedures adapted from APHA Method 4110 "Determination of Anions by Ion Chromatography" and EPA Method 300.0 "Determination of Inorganic Anions by Ion Chromatography". Anions routinely determined by this method include: bromide, chloride, fluoride, nitrate, nitrite and sulphate.

ANIONS-NO3-IC-VA Water Nitrate by Ion Chromatography APHA 4110 "Determination of Anions by IC

This analysis is carried out using procedures adapted from APHA Method 4110 "Determination of Anions by Ion Chromatography" and EPA Method 300.0 "Determination of Inorganic Anions by Ion Chromatography". Anions routinely determined by this method include: bromide, chloride, fluoride, nitrate, nitrite and sulphate.

ANIONS-SO4-IC-VA Water Sulfate by Ion Chromatography APHA 4110 "Determination of Anions by IC

This analysis is carried out using procedures adapted from APHA Method 4110 "Determination of Anions by Ion Chromatography" and EPA Method 300.0 "Determination of Inorganic Anions by Ion Chromatography". Anions routinely determined by this method include: bromide, chloride, fluoride, nitrate, nitrite and sulphate.

CARBONS-TOC-VA Water Total organic carbon by combustion APHA 5310 "TOTAL ORGANIC CARBON (TOC)"

This analysis is carried out using procedures adapted from APHA Method 5310 "Total Organic Carbon (TOC)".

EC-PCT-VA Water Conductivity (Automated) APHA 2510 Auto. Conduc.

This analysis is carried out using procedures adapted from APHA Method 2510 "Conductivity". Conductivity is determined using a conductivity electrode.

FE-TOT-LOW-ICP-VA Water Total Fe in Water by ICPOES EPA SW-846 3005A/6010B

This analysis is carried out using procedures adapted from "Standard Methods for the Examination of Water and Wastewater" published by the American Public Health Association, and with procedures adapted from "Test Methods for Evaluating Solid Waste" SW-846 published by the United States Environmental Protection Agency (EPA). The procedures may involve preliminary sample treatment by acid digestion, using either hotblock or microwave oven (EPA Method 3005A). Instrumental analysis is by inductively coupled plasma - optical emission spectrophotometry (EPA Method 6010B).

HARDNESS-CALC-VA Water Hardness APHA 2340B

Hardness is calculated from Calcium and Magnesium concentrations, and is expressed as calcium carbonate equivalents.

Reference Information

Methods Listed (if applicable):

ALS Test Code	Matrix	Test Description	Analytical Method Reference(Based On)
HG-TOT-LOW-CVAFS-VA	Water	Total Mercury in Water by CVAFS(Low)	EPA 245.7
This analysis is carried out using procedures adapted from "Standard Methods for the Examination of Water and Wastewater" published by the American Public Health Association, and with procedures adapted from "Test Methods for Evaluating Solid Waste" SW-846 published by the United States Environmental Protection Agency (EPA). The procedure involves a cold-oxidation of the acidified sample using bromine monochloride prior to reduction of the sample with stannous chloride. Instrumental analysis is by cold vapour atomic fluorescence spectrophotometry (EPA Method 245.7).			
IONBALANCE-VA	Water	Ion Balance Calculation	APHA 1030E
Cation Sum, Anion Sum, and Ion Balance (as % difference) are calculated based on guidance from APHA Standard Methods (1030E Checking Correctness of Analysis). Because all aqueous solutions are electrically neutral, the calculated ion balance (% difference of cations minus anions) should be near-zero.			
Cation and Anion Sums are the total meq/L concentration of major cations and anions. Dissolved species are used where available. Minor ions are included where data is present. Ion Balance is calculated as:			
Ion Balance (%) = [Cation Sum-Anion Sum] / [Cation Sum+Anion Sum]			
MET-TOT-ICP-VA	Water	Total Metals in Water by ICPOES	EPA SW-846 3005A/6010B
This analysis is carried out using procedures adapted from "Standard Methods for the Examination of Water and Wastewater" published by the American Public Health Association, and with procedures adapted from "Test Methods for Evaluating Solid Waste" SW-846 published by the United States Environmental Protection Agency (EPA). The procedures may involve preliminary sample treatment by acid digestion, using either hotblock or microwave oven (EPA Method 3005A). Instrumental analysis is by inductively coupled plasma - optical emission spectrophotometry (EPA Method 6010B).			
MET-TOT-LOW-MS-VA	Water	Total Metals in Water by ICPMS(Low)	EPA SW-846 3005A/6020A
This analysis is carried out using procedures adapted from "Standard Methods for the Examination of Water and Wastewater" published by the American Public Health Association, and with procedures adapted from "Test Methods for Evaluating Solid Waste" SW-846 published by the United States Environmental Protection Agency (EPA). The procedures may involve preliminary sample treatment by acid digestion, using either hotblock or microwave oven, or filtration (EPA Method 3005A). Instrumental analysis is by inductively coupled plasma - mass spectrometry (EPA Method 6020A).			
MET-TOT-ULTRA-MS-VA	Water	Total Metals in Water by ICPMS (Ultra)	EPA SW-846 3005A/6020A
This analysis is carried out using procedures adapted from "Standard Methods for the Examination of Water and Wastewater" published by the American Public Health Association, and with procedures adapted from "Test Methods for Evaluating Solid Waste" SW-846 published by the United States Environmental Protection Agency (EPA). The procedures may involve preliminary sample treatment by acid digestion, using either hotblock or microwave oven, or filtration (EPA Method 3005A). Instrumental analysis is by inductively coupled plasma - mass spectrometry (EPA Method 6020A).			
N-TOT-COMBUST-VA	Water	Total Nitrogen by Combustion	ASTM D5176-91, EN12260 (EU STD Method)
This analysis is carried out using procedures adapted from ASTM Method D 5176-91 "Standard Test Method for Total Chemically Bound Nitrogen in Water by Pyrolysis and Chemiluminescence detection." Total Nitrogen is determined directly by pyrolysis with chemiluminescence detection using automated instrumentation. Total Kjeldahl Nitrogen is determined by calculation.			
NH3-COL-VA	Water	Ammonia by Color	APHA 4500-NH3 "Nitrogen (Ammonia)"
This analysis is carried out, on unpreserved samples, using procedures adapted from APHA Method 4500-NH3 "Nitrogen (Ammonia)". Ammonia is determined using the phenate colourimetric method.			
PH-MAN-VA	Water	pH by Manual Meter	APHA 4500-H "pH Value"
This analysis is carried out using procedures adapted from APHA Method 4500-H "pH Value". The pH is determined in the laboratory using a pH electrode.			
PO4-DO-COL-VA	Water	Dissolved ortho Phosphate by Color	APHA 4500-P "Phosphorous"
This analysis is carried out using procedures adapted from APHA Method 4500-P "Phosphorus". All forms of phosphate are determined by the ascorbic acid colourimetric method. Dissolved ortho-phosphate (dissolved reactive phosphorous) is determined by direct measurement. Total phosphate (total phosphorous) is determined after persulphate digestion of a sample. Total dissolved phosphate (total dissolved phosphorous) is determined by filtering a sample through a 0.45 micron membrane filter followed by persulfate digestion of the filtrate.			
PO4-T-COL-VA	Water	Total Phosphate P by Color	APHA 4500-P "Phosphorous"
This analysis is carried out using procedures adapted from APHA Method 4500-P "Phosphorus". All forms of phosphate are determined by the ascorbic acid colourimetric method. Dissolved ortho-phosphate (dissolved reactive phosphorous) is determined by direct measurement. Total phosphate (total			

Reference Information

Methods Listed (if applicable):

ALS Test Code	Matrix	Test Description	Analytical Method Reference(Based On)
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phosphorous) is determined after persulphate digestion of a sample. Total dissolved phosphate (total dissolved phosphorous) is determined by filtering a sample through a 0.45 micron membrane filter followed by persulfate digestion of the filtrate.

TDS-CALC-VA	Water	TDS (Calculation from EC)	APHA 1030E (20TH EDITION)
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This analysis is carried out using procedures adapted from APHA 1030E "Checking Correctness of Analyses".

TKN-CALC-VA	Water	TKN by Calculation via TN combustion	BC MOE LABORATORY MANUAL (2005)
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This analysis is carried out using procedures adapted from ASTM Method D 5176-91 "Standard Test Method for Total Chemically Bound Nitrogen in Water by Pyrolysis and Chemiluminescence detection." Total Nitrogen is determined directly by pyrolysis with chemiluminescence detection using automated instrumentation. Total Kjeldahl Nitrogen is determined by calculation.

TSS-VA	Water	Solids by Gravimetric	APHA 2540 Gravimetric
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This analysis is carried out using procedures adapted from APHA Method 2540 "Solids". Solids are determined gravimetrically. Total suspended solids (TSS) are determined by filtering a sample through a glass fibre filter, TSS is determined by drying the filter at 104 degrees celsius.

TURBIDITY-VA	Water	Turbidity by Meter	APHA 2130 "Turbidity"
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This analysis is carried out using procedures adapted from APHA Method 2130 "Turbidity". Turbidity is determined by the nephelometric method.

**** Laboratory Methods employed follow in-house procedures, which are generally based on nationally or internationally accepted methodologies. The last two letters of the above ALS Test Code column indicate the laboratory that performed analytical analysis for that test. Refer to the list below:**

Laboratory Definition Code	Laboratory Location	Laboratory Definition Code	Laboratory Location
VA	ALS LABORATORY GROUP - VANCOUVER, BC, CANADA		

GLOSSARY OF REPORT TERMS

Surr - A surrogate is an organic compound that is similar to the target analyte(s) in chemical composition and behavior but not normally detected in environmental samples. Prior to sample processing, samples are fortified with one or more surrogate compounds.

The reported surrogate recovery value provides a measure of method efficiency.

mg/kg (units) - unit of concentration based on mass, parts per million

mg/L (units) - unit of concentration based on volume, parts per million

N/A - Result not available. Refer to qualifier code and definition for explanation

Test results reported relate only to the samples as received by the laboratory.

UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.

Although test results are generated under strict QA/QC protocols, any unsigned test reports, faxes, or emails are considered preliminary.

ALS Laboratory Group has an extensive QA/QC program where all analytical data reported is analyzed using approved referenced procedures followed by checks and reviews by senior managers and quality assurance personnel. However, since the results are obtained from chemical measurements and thus cannot be guaranteed, ALS Laboratory Group assumes no liability for the use or interpretation of the results.



L620149

CHAIN OF CUSTODY FORM

For Lab Use																			
Station ID	Matrix	Date	Time	Init		AEMP-Nutrients/Organics	AEMP-Physical/Parameters	AEMP-Total Metals	Fluoride										
AQ-C4	F1	Snow	4/11/2008	3:30:00 PM W	1	1	1	1	BHP2										
AQ-101		Snow	4/11/2008	2:20:00 PM W	1	1	1	1	BHP2										
AQ-C4		Snow	4/11/2008	3:15:00 PM W	1	1	1	1	BHP2										
AQ-43		Snow	4/11/2008	4:15:00 PM W	1	1	1	1	BHP2										
AQ-32		Snow	4/11/2008	5:00:00 PM W	1	1	1	1	BHP2										
AQ-29		Snow	4/9/2008	3:00:00 PM JE	1	1	1	1	BHP2										
AQ-19		Snow	4/9/2008	5:45:00 PM JE	1	1	1	1	BHP2										

Turn around Required: Regular two week turnaround

Special Instructions (Billing details, QC reporting, etc):

Billing Code: BHP2501

Relinquished by: WB	Date: 14-Apr-08 Time: 17:30	Received by: [Signature]	Date: 08/04/16 Time: 15:10
Relinquished by:	Date:	Received by:	Date:
	Time:		Time:

FOR LAB USE ONLY			
Cooler seal intact upon receipt?		Sample temperature upon receipt: 9 C.	
<input checked="" type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> N/A	
Frozen?		<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No

Send Analytical Results to:
compliance.team@bhpbilliton.com



Environmental Division

ANALYTICAL REPORT

BHP BILLITON DIAMONDS INC.

ATTN: RICHARD EHLERT

1102 - 4920 52ND STREET

YELLOWKNIFE NT X1A 3T1

Reported On: 20-MAY-08 06:03 PM

Lab Work Order #: L623869

Date Received: 29-APR-08

Project P.O. #: BHP2501

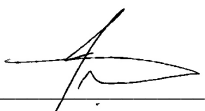
Job Reference: 10971

Legal Site Desc: 6200504479

CofC Numbers:

Other Information:

Comments: Due to limited sample volume available not all of the analyses requested could be performed for some of the samples.



Joyce Chow
General Manager, Vancouver

For any questions about this report please contact your Account Manager:

Can Dang

THIS REPORT SHALL NOT BE REPRODUCED EXCEPT IN FULL WITHOUT THE WRITTEN AUTHORITY OF THE LABORATORY.
ALL SAMPLES WILL BE DISPOSED OF AFTER 30 DAYS FOLLOWING ANALYSIS. PLEASE CONTACT THE LAB IF YOU
REQUIRE ADDITIONAL SAMPLE STORAGE TIME.

ALS LABORATORY GROUP ANALYTICAL REPORT

		Sample ID	L623869-1	L623869-2	L623869-3	L623869-4	L623869-5
		Description					
		Sampled Date	19-APR-08	19-APR-08	18-APR-08	19-APR-08	20-APR-08
		Sampled Time	15:40	11:50	15:18	09:47	11:50
		Client ID	AQ-102	AQ-109	AQ-114	AQ-108	AQ-107
Grouping	Analyte						
WATER							
Physical Tests	Anion Sum (meq/L)	<0.1	<0.1	<0.1	<0.1	<0.1	
	Cation Sum (meq/L)	<0.1	<0.1	<0.1	0.1	<0.1	
	Cation - Anion Balance (%)	85.8	79.1	84.9	0.0	74.9	
	Hardness (as CaCO3) (mg/L)	1.57	1.30	1.84	1.83	1.49	
	Conductivity (uS/cm)	4.3	6.0	3.3	3.7	5.8	
	pH (pH)	5.55	5.22	5.49	5.32	5.20	
	Total Dissolved Solids (mg/L)	7.4		4.3		8.1	
	Total Suspended Solids (mg/L)	14.7		15.3		17.3	
	Turbidity (NTU)	3.07	4.04	3.68	6.93	1.50	
Anions and Nutrients	Ammonia as N (mg/L)	<0.0050	0.0085	<0.0050	<0.0050	<0.0050	
	Alkalinity, Bicarbonate (as CaCO3) (mg/L)	<2.0	<2.0	<2.0	<2.0	<2.0	
	Alkalinity, Carbonate (as CaCO3) (mg/L)	<2.0	<2.0	<2.0	<2.0	<2.0	
	Alkalinity, Hydroxide (as CaCO3) (mg/L)	<2.0	<2.0	<2.0	<2.0	<2.0	
	Alkalinity, Total (as CaCO3) (mg/L)	<2.0	<2.0	<2.0	<2.0	<2.0	
	Chloride (Cl) (mg/L)	<0.50	<0.50	<0.50	<0.50	<0.50	
	Fluoride (F) (mg/L)	<0.020	<0.020	<0.020	<0.020	<0.020	
	Sulphate (SO4) (mg/L)	0.30	0.26	0.23	<0.20	0.41	
	Nitrate (as N) (mg/L)	<0.0050	0.0213	0.0090	<0.0050	<0.0050	
	Nitrite (as N) (mg/L)	<0.0010	0.0010	<0.0010	<0.0010	<0.0010	
	Total Kjeldahl Nitrogen (mg/L)	0.120	0.118	0.061	0.090	0.080	
	Ortho Phosphate as P (mg/L)	0.0304	<0.0010	0.0244	0.0095	0.0517	
	Total Phosphate as P (mg/L)	0.0525	0.0136	0.0411	0.0277	0.0724	
Total Metals	Aluminum (Al)-Total (mg/L)	0.168	0.103	0.119	0.395	0.0786	
	Antimony (Sb)-Total (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	
	Arsenic (As)-Total (mg/L)	0.000086	0.000058	0.000054	0.000120	0.000053	
	Barium (Ba)-Total (mg/L)	0.00375	0.00290	0.00376	0.00466	0.00218	
	Beryllium (Be)-Total (mg/L)	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	
	Boron (B)-Total (mg/L)	0.0011	0.0010	<0.0010	0.0014	0.0012	
	Cadmium (Cd)-Total (mg/L)	<0.000050	0.000066	<0.000050	0.000070	<0.000050	
	Calcium (Ca)-Total (mg/L)	0.198	0.244	0.177	0.206	0.256	
	Chromium (Cr)-Total (mg/L)	0.00080	0.00036	0.00085	0.00187	0.00043	
	Cobalt (Co)-Total (mg/L)	0.00011	<0.00010	0.00016	0.00018	<0.00010	
	Copper (Cu)-Total (mg/L)	0.00055	0.00042	0.00040	0.00145	0.00049	
	Iron (Fe)-Total (mg/L)	0.176	0.095	0.142	0.314	0.050	
	Lead (Pb)-Total (mg/L)	0.000299	0.000438	0.000184	0.000944	0.000275	
	Magnesium (Mg)-Total (mg/L)	0.262	0.167	0.339	0.320	0.205	
	Manganese (Mn)-Total (mg/L)	0.00484	0.00788	0.0132	0.00794	0.0180	
	Mercury (Hg)-Total (mg/L)	<0.000020	<0.000020	<0.000020	<0.000020	<0.000020	

ALS LABORATORY GROUP ANALYTICAL REPORT

		Sample ID	L623869-6	L623869-7	L623869-8	L623869-9	L623869-10
		Description					
		Sampled Date	18-APR-08	18-APR-08	18-APR-08	20-APR-08	19-APR-08
		Sampled Time	11:04	13:04	14:18	16:45	16:40
		Client ID	AQ-110	AQ-111	AQ-112	AQ-103	AQ-105
Grouping	Analyte						
WATER							
Physical Tests	Anion Sum (meq/L)	<0.1	<0.1	<0.1	<0.1	<0.1	
	Cation Sum (meq/L)	<0.1	<0.1	<0.1	<0.1	<0.1	
	Cation - Anion Balance (%)	86.4	75.0	77.2	58.2	94.9	
	Hardness (as CaCO3) (mg/L)	0.51	0.63	1.80	1.20	0.74	
	Conductivity (uS/cm)	3.4	3.4	3.8	5.4	3.6	
	pH (pH)	5.31	5.57	5.50	5.15	5.36	
	Total Dissolved Solids (mg/L)	<1.0	1.6	2.6	2.8	4.0	
	Total Suspended Solids (mg/L)	<3.0	6.7	6.7	6.7	29.3	
	Turbidity (NTU)	4.43	2.39	5.42	1.74	2.96	
Anions and Nutrients	Ammonia as N (mg/L)	0.0149	0.0116	0.0246	<0.0050	<0.0050	
	Alkalinity, Bicarbonate (as CaCO3) (mg/L)	<2.0	<2.0	<2.0	<2.0	<2.0	
	Alkalinity, Carbonate (as CaCO3) (mg/L)	<2.0	<2.0	<2.0	<2.0	<2.0	
	Alkalinity, Hydroxide (as CaCO3) (mg/L)	<2.0	<2.0	<2.0	<2.0	<2.0	
	Alkalinity, Total (as CaCO3) (mg/L)	<2.0	<2.0	<2.0	<2.0	<2.0	
	Chloride (Cl) (mg/L)	<0.50	<0.50	<0.50	<0.50	<0.50	
	Fluoride (F) (mg/L)	<0.020	<0.020	<0.020	<0.020	<0.020	
	Sulphate (SO4) (mg/L)	<0.20	<0.20	0.30	0.42	<0.20	
	Nitrate (as N) (mg/L)	0.0575	0.0742	0.0861	0.0855	0.0141	
	Nitrite (as N) (mg/L)	<0.0010	<0.0010	0.0010	<0.0010	<0.0010	
	Total Kjeldahl Nitrogen (mg/L)	<0.050	<0.050	<0.050	<0.050	0.056	
	Ortho Phosphate as P (mg/L)	<0.0010	0.0041	0.0020	0.0027	<0.0010	
	Total Phosphate as P (mg/L)	0.0024	0.0068	0.0097	0.0094	0.0169	
Total Metals	Aluminum (Al)-Total (mg/L)	0.294	0.123	0.347	0.109	0.0696	
	Antimony (Sb)-Total (mg/L)	0.00014	<0.00010	<0.00010	<0.00010	<0.00010	
	Arsenic (As)-Total (mg/L)	0.000041	0.000032	0.000051	0.000053	0.000039	
	Barium (Ba)-Total (mg/L)	0.00134	0.00226	0.00425	0.00428	0.00216	
	Beryllium (Be)-Total (mg/L)	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	
	Boron (B)-Total (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	
	Cadmium (Cd)-Total (mg/L)	0.000080	<0.000050	<0.000050	<0.000050	<0.000050	
	Calcium (Ca)-Total (mg/L)	0.070	0.102	0.210	0.220	0.152	
	Chromium (Cr)-Total (mg/L)	0.00113	0.00041	0.00108	0.00049	0.00034	
	Cobalt (Co)-Total (mg/L)	<0.00010	<0.00010	0.00018	0.00011	<0.00010	
	Copper (Cu)-Total (mg/L)	0.00231	0.00035	0.00156	0.00060	0.00066	
	Iron (Fe)-Total (mg/L)	0.075	0.067	0.225	0.097	0.048	
	Lead (Pb)-Total (mg/L)	0.000960	0.000229	0.000682	0.000311	0.000286	
	Magnesium (Mg)-Total (mg/L)	0.0807	0.0915	0.310	0.158	0.0870	
	Manganese (Mn)-Total (mg/L)	0.00193	0.00460	0.00388	0.0152	0.00865	
	Mercury (Hg)-Total (mg/L)	<0.000020	<0.000020	<0.000020	<0.000020	<0.000020	

ALS LABORATORY GROUP ANALYTICAL REPORT

		Sample ID Description Sampled Date Sampled Time Client ID	L623869-11	L623869-13	L623869-14	L623869-15	L623869-16
			18-APR-08 15:25 AQ-114	19-APR-08 13:50 AQ-113	20-APR-08 13:17 AQ-106	21-APR-08 10:20 AQ-02-SNOW	21-APR-08 11:20 AQ-02
Grouping	Analyte						
WATER							
Physical Tests	Anion Sum (meq/L)	<0.1	<0.1	<0.1	<0.1	<0.1	
	Cation Sum (meq/L)	<0.1	0.1	<0.1	0.1	0.2	
	Cation - Anion Balance (%)	88.2	79.0	85.4	86.9	89.3	
	Hardness (as CaCO3) (mg/L)	2.10	3.52	1.92	3.54	3.54	
	Conductivity (uS/cm)	4.8	4.3	6.0	3.4	3.0	
	pH (pH)	5.51	5.65	5.11	5.49	5.49	
	Total Dissolved Solids (mg/L)	5.0	3.4	9.3	6.3	4.1	
	Total Suspended Solids (mg/L)	15.3	12.7	20.0	19.3	12.7	
	Turbidity (NTU)	2.92	3.93	2.73	6.83	3.28	
Anions and Nutrients	Ammonia as N (mg/L)	<0.0050	0.0199	0.0077	0.0077	<0.0050	
	Alkalinity, Bicarbonate (as CaCO3) (mg/L)	<2.0	<2.0	<2.0	<2.0	<2.0	
	Alkalinity, Carbonate (as CaCO3) (mg/L)	<2.0	<2.0	<2.0	<2.0	<2.0	
	Alkalinity, Hydroxide (as CaCO3) (mg/L)	<2.0	<2.0	<2.0	<2.0	<2.0	
	Alkalinity, Total (as CaCO3) (mg/L)	<2.0	<2.0	<2.0	<2.0	<2.0	
	Chloride (Cl) (mg/L)	<0.50	<0.50	<0.50	<0.50	<0.50	
	Fluoride (F) (mg/L)	<0.020	<0.020	<0.020	<0.020	<0.020	
	Sulphate (SO4) (mg/L)	0.23	0.50	0.25	0.24	0.27	
	Nitrate (as N) (mg/L)	<0.0050	0.0777	<0.0050	0.0469	0.0454	
	Nitrite (as N) (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010	0.0022	
	Total Kjeldahl Nitrogen (mg/L)	<0.050	<0.050	0.110	0.143	<0.050	
	Ortho Phosphate as P (mg/L)	0.0081	0.0031	0.0141	0.0105	0.0049	
	Total Phosphate as P (mg/L)	0.0214	0.0109	0.0357	0.0642	0.0183	
Total Metals	Aluminum (Al)-Total (mg/L)	0.0958	0.289	0.0887	0.207	0.479	
	Antimony (Sb)-Total (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	
	Arsenic (As)-Total (mg/L)	0.000066	0.000061	0.000049	0.000051	0.000067	
	Barium (Ba)-Total (mg/L)	0.00527	0.00863	0.00548	0.0103	0.0100	
	Beryllium (Be)-Total (mg/L)	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	
	Boron (B)-Total (mg/L)	0.0014	<0.0010	0.0010	0.0011	<0.0010	
	Cadmium (Cd)-Total (mg/L)	<0.000050	0.000050	0.000051	0.000074	<0.000050	
	Calcium (Ca)-Total (mg/L)	0.346	0.277	0.414	0.755	0.339	
	Chromium (Cr)-Total (mg/L)	0.00046	0.00156	0.00031	0.00101	0.00182	
	Cobalt (Co)-Total (mg/L)	0.00013	0.00034	<0.00010	0.00021	0.00035	
	Copper (Cu)-Total (mg/L)	0.00061	0.00052	0.00080	0.00082	0.00074	
	Iron (Fe)-Total (mg/L)	0.110	0.367	0.064	0.242	0.481	
	Lead (Pb)-Total (mg/L)	0.000253	0.000379	0.000340	0.000305	0.000390	
	Magnesium (Mg)-Total (mg/L)	0.299	0.687	0.214	0.403	0.653	
	Manganese (Mn)-Total (mg/L)	0.0374	0.00609	0.0175	0.0276	0.00971	
	Mercury (Hg)-Total (mg/L)	<0.000020	<0.000020	<0.000020	<0.000020	<0.000020	

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		Sample ID	L623869-17	L623869-18	L623869-19	L623869-20	L623869-21
		Description					
		Sampled Date	21-APR-08	21-APR-08	21-APR-08	21-APR-08	19-APR-08
		Sampled Time	10:20	15:03	14:07	13:19	11:01
		Client ID	AQ-31	AQ-06	AQ-05	AQ-04	AQ-48
Grouping	Analyte						
WATER							
Physical Tests	Anion Sum (meq/L)	<0.1	<0.1	0.3	<0.1	<0.1	
	Cation Sum (meq/L)	0.7	0.4	1.8	0.3	<0.1	
	Cation - Anion Balance (%)	76.6	95.1	69.0	94.9	70.5	
	Hardness (as CaCO3) (mg/L)	19.1	10.3	57.3	7.64	<0.50	
	Conductivity (uS/cm)	11.2	4.1	42.3	6.6	3.8	
	pH (pH)	6.21	5.90	6.10	5.63	5.21	
	Total Dissolved Solids (mg/L)	19.0	8.9	41.4	10.8		
	Total Suspended Solids (mg/L)	80.0	46.0	81.3	46.0		
	Turbidity (NTU)	24.3	13.3	23.4	11.6	1.73	
Anions and Nutrients	Ammonia as N (mg/L)	0.240	<0.0050	0.0135	0.0059	0.0117	
	Alkalinity, Bicarbonate (as CaCO3) (mg/L)	4.1	<2.0	5.4	<2.0	<2.0	
	Alkalinity, Carbonate (as CaCO3) (mg/L)	<2.0	<2.0	<2.0	<2.0	<2.0	
	Alkalinity, Hydroxide (as CaCO3) (mg/L)	<2.0	<2.0	<2.0	<2.0	<2.0	
	Alkalinity, Total (as CaCO3) (mg/L)	4.1	<2.0	5.4	<2.0	<2.0	
	Chloride (Cl) (mg/L)	<0.50	<0.50	6.75	<0.50	<0.50	
	Fluoride (F) (mg/L)	<0.020	<0.020	<0.020	<0.020	<0.020	
	Sulphate (SO4) (mg/L)	0.46	0.29	1.36	0.38	<0.20	
	Nitrate (as N) (mg/L)	0.0665	0.0581	0.0057	<0.0050	0.0510	
	Nitrite (as N) (mg/L)	<0.0010	0.0014	<0.0010	<0.0010	<0.0010	
	Total Kjeldahl Nitrogen (mg/L)	0.534	<0.050	0.064	0.140	<0.050	
	Ortho Phosphate as P (mg/L)	0.0186	0.0030	0.0665	0.0226	0.0013	
	Total Phosphate as P (mg/L)	0.197	0.0449	0.155	0.0795	0.0028	
Total Metals	Aluminum (Al)-Total (mg/L)	1.76	1.11	2.64	0.751	0.0423	
	Antimony (Sb)-Total (mg/L)	<0.00010	<0.00010	0.00011	<0.00010	<0.00010	
	Arsenic (As)-Total (mg/L)	0.000237	0.000133	0.000437	0.000119	0.000040	
	Barium (Ba)-Total (mg/L)	0.0477	0.0233	0.0872	0.0187	0.000621	
	Beryllium (Be)-Total (mg/L)	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	
	Boron (B)-Total (mg/L)	0.0018	0.0022	0.0024	0.0012	<0.0010	
	Cadmium (Cd)-Total (mg/L)	0.000053	<0.000050	0.000054	0.000059	<0.000050	
	Calcium (Ca)-Total (mg/L)	1.50	1.21	4.41	0.822	0.052	
	Chromium (Cr)-Total (mg/L)	0.00902	0.00436	0.0226	0.00339	0.00033	
	Cobalt (Co)-Total (mg/L)	0.00202	0.00093	0.00543	0.00074	<0.00010	
	Copper (Cu)-Total (mg/L)	0.00292	0.00211	0.00489	0.00134	<0.00030	
	Iron (Fe)-Total (mg/L)	2.22	1.09	4.40	0.816	0.033	
	Lead (Pb)-Total (mg/L)	0.00118	0.000509	0.000982	0.000486	0.000170	
	Magnesium (Mg)-Total (mg/L)	3.73	1.77	11.2	1.36	0.0503	
	Manganese (Mn)-Total (mg/L)	0.0474	0.0553	0.125	0.0489	0.00100	
	Mercury (Hg)-Total (mg/L)	<0.000020	<0.000020	<0.000020	<0.000020	<0.000020	

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		Sample ID	L623869-22	L623869-23	L623869-24	L623869-25	L623869-26
		Description					
		Sampled Date	19-APR-08	20-APR-08	20-APR-08	20-APR-08	19-APR-08
		Sampled Time	13:02	15:50	14:06	15:05	15:10
		Client ID	AQ-44	AQ-104	AQ-C5	AQ-C2	AQ-35
Grouping	Analyte						
WATER							
Physical Tests	Anion Sum (meq/L)	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
	Cation Sum (meq/L)	<0.1	<0.1	<0.1	0.1	<0.1	<0.1
	Cation - Anion Balance (%)	0.0	61.7	66.4	92.1	5.2	5.2
	Hardness (as CaCO3) (mg/L)	1.93	0.79	1.38	3.55	1.14	1.14
	Conductivity (uS/cm)	6.6	4.5	3.9	4.8	11.1	11.1
	pH (pH)	5.05	5.16	5.21	5.33	5.13	5.13
	Total Dissolved Solids (mg/L)	11.4	3.3	2.6	9.9		
	Total Suspended Solids (mg/L)	6.0	10.7	6.0	6.7		
	Turbidity (NTU)	3.15	4.02	2.60	10.2	5.64	5.64
Anions and Nutrients	Ammonia as N (mg/L)	0.0102	<0.0050	<0.0050	<0.0050	0.0062	0.0062
	Alkalinity, Bicarbonate (as CaCO3) (mg/L)	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
	Alkalinity, Carbonate (as CaCO3) (mg/L)	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
	Alkalinity, Hydroxide (as CaCO3) (mg/L)	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
	Alkalinity, Total (as CaCO3) (mg/L)	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
	Chloride (Cl) (mg/L)	<0.50	<0.50	<0.50	<0.50	1.52	1.52
	Fluoride (F) (mg/L)	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
	Sulphate (SO4) (mg/L)	<0.20	0.34	0.25	0.27	0.36	0.36
	Nitrate (as N) (mg/L)	<0.0050	0.0405	0.0765	<0.0050	<0.0050	<0.0050
	Nitrite (as N) (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Total Kjeldahl Nitrogen (mg/L)	0.090	<0.050	<0.050	0.120	<0.25	<0.25
	Ortho Phosphate as P (mg/L)	0.0331	<0.0010	<0.0010	0.0334	0.0019	0.0019
	Total Phosphate as P (mg/L)	0.0451	0.0163	0.0056	0.0616	0.0150	0.0150
Total Metals	Aluminum (Al)-Total (mg/L)	0.120	0.0822	0.107	0.247	0.101	0.101
	Antimony (Sb)-Total (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Arsenic (As)-Total (mg/L)	0.000043	0.000068	0.000033	0.000062	0.000071	0.000071
	Barium (Ba)-Total (mg/L)	0.00416	0.00229	0.00302	0.0136	0.00457	0.00457
	Beryllium (Be)-Total (mg/L)	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
	Boron (B)-Total (mg/L)	0.0011	0.0011	0.0015	0.0017	0.0010	0.0010
	Cadmium (Cd)-Total (mg/L)	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
	Calcium (Ca)-Total (mg/L)	0.401	0.132	0.223	0.464	0.224	0.224
	Chromium (Cr)-Total (mg/L)	0.00045	0.00044	0.00046	0.00148	0.00050	0.00050
	Cobalt (Co)-Total (mg/L)	<0.00010	<0.00010	<0.00010	0.00030	0.00011	0.00011
	Copper (Cu)-Total (mg/L)	<0.00040	<0.00050	<0.00050	<0.00090	<0.00070	<0.00070
	Iron (Fe)-Total (mg/L)	0.084	0.066	0.084	0.286	0.113	0.113
	Lead (Pb)-Total (mg/L)	0.000203	0.000307	0.000174	0.000321	0.000368	0.000368
	Magnesium (Mg)-Total (mg/L)	0.226	0.111	0.199	0.581	0.140	0.140
	Manganese (Mn)-Total (mg/L)	0.0266	0.00747	0.0147	0.0570	0.0129	0.0129
	Mercury (Hg)-Total (mg/L)	<0.000020	<0.000020	<0.000020	<0.000020	<0.000020	<0.000020

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		Sample ID	L623869-1	L623869-2	L623869-3	L623869-4	L623869-5
		Description					
		Sampled Date	19-APR-08	19-APR-08	18-APR-08	19-APR-08	20-APR-08
		Sampled Time	15:40	11:50	15:18	09:47	11:50
		Client ID	AQ-102	AQ-109	AQ-114	AQ-108	AQ-107
Grouping	Analyte						
WATER							
Total Metals	Molybdenum (Mo)-Total (mg/L)	0.0131	0.0425	0.00555	0.0397	0.00803	
	Nickel (Ni)-Total (mg/L)	0.00099	0.00080	0.00225	0.00226	0.00057	
	Potassium (K)-Total (mg/L)	0.666	0.281	0.203	0.272	0.356	
	Selenium (Se)-Total (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	0.00011	
	Silicon (Si)-Total (mg/L)	0.349	0.195	0.400	0.552	0.099	
	Silver (Ag)-Total (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	
	Sodium (Na)-Total (mg/L)	0.110	0.118	0.091	0.072	0.078	
	Strontium (Sr)-Total (mg/L)	0.00173	0.00139	0.00155	0.00120	0.00082	
	Uranium (U)-Total (mg/L)	0.000021	0.000021	0.000014	0.000125	0.000017	
	Vanadium (V)-Total (mg/L)	0.000389	0.000249	0.000272	0.000593	0.000181	
	Zinc (Zn)-Total (mg/L)	<0.0050	<0.0050	<0.0050	0.0163	<0.0090	
Organic Parameters	Total Organic Carbon (mg/L)	5.48	6.77	2.94	5.92	6.60	

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		Sample ID	L623869-6	L623869-7	L623869-8	L623869-9	L623869-10
		Description					
		Sampled Date	18-APR-08	18-APR-08	18-APR-08	20-APR-08	19-APR-08
		Sampled Time	11:04	13:04	14:18	16:45	16:40
		Client ID	AQ-110	AQ-111	AQ-112	AQ-103	AQ-105
Grouping	Analyte						
WATER							
Total Metals	Molybdenum (Mo)-Total (mg/L)	0.105	0.00367	0.0285	0.00385	0.00846	
	Nickel (Ni)-Total (mg/L)	0.00380	0.00066	0.00317	0.00122	0.00043	
	Potassium (K)-Total (mg/L)	<0.050	0.080	0.130	0.166	0.184	
	Selenium (Se)-Total (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	
	Silicon (Si)-Total (mg/L)	0.135	0.090	0.427	0.200	0.083	
	Silver (Ag)-Total (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	
	Sodium (Na)-Total (mg/L)	0.100	0.060	0.114	0.101	0.108	
	Strontium (Sr)-Total (mg/L)	0.00063	0.00067	0.00163	0.00107	0.00069	
	Uranium (U)-Total (mg/L)	0.000031	0.000012	0.000034	0.000017	0.000012	
	Vanadium (V)-Total (mg/L)	0.000175	0.000209	0.000513	0.000223	0.000130	
	Zinc (Zn)-Total (mg/L)	0.0175	<0.0060	<0.0090	<0.0080	<0.0060	
Organic Parameters	Total Organic Carbon (mg/L)	<0.50	0.81	0.65	1.21	3.25	

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		Sample ID	L623869-11	L623869-13	L623869-14	L623869-15	L623869-16
		Description					
		Sampled Date	18-APR-08	19-APR-08	20-APR-08	21-APR-08	21-APR-08
		Sampled Time	15:25	13:50	13:17	10:20	11:20
		Client ID	AQ-114	AQ-113	AQ-106	AQ-02-SNOW	AQ-02
Grouping	Analyte						
WATER							
Total Metals	Molybdenum (Mo)-Total (mg/L)	0.00710	0.00903	0.00941	0.00813	0.00179	
	Nickel (Ni)-Total (mg/L)	0.00183	0.00427	0.00069	0.00217	0.00397	
	Potassium (K)-Total (mg/L)	0.369	0.231	0.491	0.333	0.311	
	Selenium (Se)-Total (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	
	Silicon (Si)-Total (mg/L)	0.250	0.741	0.130	0.407	1.16	
	Silver (Ag)-Total (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	
	Sodium (Na)-Total (mg/L)	0.097	0.217	0.079	0.088	0.126	
	Strontium (Sr)-Total (mg/L)	0.00159	0.00372	0.00124	0.00404	0.00345	
	Uranium (U)-Total (mg/L)	0.000014	0.000037	0.000024	0.000030	0.000052	
	Vanadium (V)-Total (mg/L)	0.000243	0.000782	0.000145	0.000579	0.00104	
	Zinc (Zn)-Total (mg/L)	<0.0040	<0.0060	<0.0090	0.0324	0.0167	
Organic Parameters	Total Organic Carbon (mg/L)	3.44	0.58	7.76	3.80	1.30	

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		Sample ID	L623869-17	L623869-18	L623869-19	L623869-20	L623869-21
		Description					
		Sampled Date	21-APR-08	21-APR-08	21-APR-08	21-APR-08	19-APR-08
		Sampled Time	10:20	15:03	14:07	13:19	11:01
		Client ID	AQ-31	AQ-06	AQ-05	AQ-04	AQ-48
Grouping	Analyte						
WATER							
Total Metals	Molybdenum (Mo)-Total (mg/L)		0.0298	0.00402	0.00625	0.00392	0.00573
	Nickel (Ni)-Total (mg/L)		0.0250	0.00981	0.0837	0.00746	0.00020
	Potassium (K)-Total (mg/L)		1.46	1.02	2.89	0.893	<0.050
	Selenium (Se)-Total (mg/L)		0.00011	0.00010	0.00016	<0.00010	0.00011
	Silicon (Si)-Total (mg/L)		6.15	2.85	14.5	1.96	0.054
	Silver (Ag)-Total (mg/L)		<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Sodium (Na)-Total (mg/L)		0.319	0.281	2.48	0.186	0.141
	Strontium (Sr)-Total (mg/L)		0.0168	0.00932	0.0682	0.00684	0.00039
	Uranium (U)-Total (mg/L)		0.000193	0.000087	0.000256	0.000085	<0.000010
	Vanadium (V)-Total (mg/L)		0.00416	0.00250	0.00696	0.00178	0.000088
	Zinc (Zn)-Total (mg/L)		<0.012	<0.0090	0.0161	<0.012	<0.0050
Organic Parameters	Total Organic Carbon (mg/L)		4.54	1.92	1.74	5.49	0.61

ALS LABORATORY GROUP ANALYTICAL REPORT

		Sample ID	L623869-22	L623869-23	L623869-24	L623869-25	L623869-26
		Description					
		Sampled Date	19-APR-08	20-APR-08	20-APR-08	20-APR-08	19-APR-08
		Sampled Time	13:02	15:50	14:06	15:05	15:10
		Client ID	AQ-44	AQ-104	AQ-C5	AQ-C2	AQ-35
Grouping	Analyte						
WATER							
Total Metals	Molybdenum (Mo)-Total (mg/L)		0.00592	0.0115	0.00376	0.00636	0.00128
	Nickel (Ni)-Total (mg/L)		0.00074	0.00050	0.00120	0.00314	0.00073
	Potassium (K)-Total (mg/L)		0.218	0.124	0.167	0.759	0.196
	Selenium (Se)-Total (mg/L)		0.00015	0.00016	<0.00010	0.00011	0.00011
	Silicon (Si)-Total (mg/L)		0.130	0.163	0.220	0.653	0.167
	Silver (Ag)-Total (mg/L)		<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Sodium (Na)-Total (mg/L)		0.075	0.099	0.070	0.094	0.097
	Strontium (Sr)-Total (mg/L)		0.00159	0.00081	0.00112	0.00298	0.00163
	Uranium (U)-Total (mg/L)		0.000011	0.000042	0.000023	0.000044	0.000020
	Vanadium (V)-Total (mg/L)		0.000191	0.000202	0.000187	0.000542	0.000220
	Zinc (Zn)-Total (mg/L)		<0.0060	<0.0040	<0.0060	<0.010	0.0101
Organic Parameters	Total Organic Carbon (mg/L)		10.4	2.22	1.29	7.14	5.61

Reference Information

Qualifiers for Sample Submission Listed:

Qualifier	Description
ISCR:ST	Improper Sample Container Received: Subsamples Taken - ALLSAMPLES 125 ML GLASS AMBER, SAMPLE 15 - 125 ML TOTAL METALS

Methods Listed (if applicable):

ALS Test Code	Matrix	Test Description	Analytical Method Reference(Based On)
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ALK-SCR-VA Water Alkalinity by colour or titration EPA 310.2 OR APHA 2320

This analysis is carried out using procedures adapted from EPA Method 310.2 "Alkalinity". Total Alkalinity is determined using the methyl orange colourimetric method.

OR

This analysis is carried out using procedures adapted from APHA Method 2320 "Alkalinity". Total alkalinity is determined by potentiometric titration to a pH 4.5 endpoint. Bicarbonate, carbonate and hydroxide alkalinity are calculated from phenolphthalein alkalinity and total alkalinity values.

ANIONS-CL-IC-VA Water Chloride by Ion Chromatography APHA 4110 "Determination of Anions by IC

This analysis is carried out using procedures adapted from APHA Method 4110 "Determination of Anions by Ion Chromatography" and EPA Method 300.0 "Determination of Inorganic Anions by Ion Chromatography". Anions routinely determined by this method include: bromide, chloride, fluoride, nitrate, nitrite and sulphate.

ANIONS-F-IC-VA Water Fluoride by Ion Chromatography APHA 4110 "Determination of Anions by IC

This analysis is carried out using procedures adapted from APHA Method 4110 "Determination of Anions by Ion Chromatography" and EPA Method 300.0 "Determination of Inorganic Anions by Ion Chromatography". Anions routinely determined by this method include: bromide, chloride, fluoride, nitrate, nitrite and sulphate.

ANIONS-NO2-IC-VA Water Nitrite by Ion Chromatography APHA 4110 "Determination of Anions by IC

This analysis is carried out using procedures adapted from APHA Method 4110 "Determination of Anions by Ion Chromatography" and EPA Method 300.0 "Determination of Inorganic Anions by Ion Chromatography". Anions routinely determined by this method include: bromide, chloride, fluoride, nitrate, nitrite and sulphate.

ANIONS-NO3-IC-VA Water Nitrate by Ion Chromatography APHA 4110 "Determination of Anions by IC

This analysis is carried out using procedures adapted from APHA Method 4110 "Determination of Anions by Ion Chromatography" and EPA Method 300.0 "Determination of Inorganic Anions by Ion Chromatography". Anions routinely determined by this method include: bromide, chloride, fluoride, nitrate, nitrite and sulphate.

ANIONS-SO4-LOW-IC-VA Water Low level Sulphate by IC APHA 4110 "Determination of Anions by IC

This analysis is carried out using procedures adapted from APHA Method 4110 "Determination of Anions by Ion Chromatography" and EPA Method 300.0 "Determination of Inorganic Anions by Ion Chromatography". Anions routinely determined by this method include: bromide, chloride, fluoride, nitrate, nitrite and sulphate.

CARBONS-TOC-VA Water Total organic carbon by combustion APHA 5310 "TOTAL ORGANIC CARBON (TOC)"

This analysis is carried out using procedures adapted from APHA Method 5310 "Total Organic Carbon (TOC)".

EC-MAN-VA Water Conductivity (Manual) APHA 2510 "Conductivity"

This analysis is carried out using procedures adapted from APHA Method 2510 "Conductivity". Conductivity is determined using a conductivity electrode.

EC-PCT-VA Water Conductivity (Automated) APHA 2510 Auto. Conduc.

This analysis is carried out using procedures adapted from APHA Method 2510 "Conductivity". Conductivity is determined using a conductivity electrode.

F-SIE-VA Water Fluoride by SIE APHA 4500-F "Fluoride"

This analysis is carried out using procedures adapted from APHA Method 4500-F "Fluoride". Fluoride is determined using a selective ion electrode.

Reference Information

Methods Listed (if applicable):

ALS Test Code	Matrix	Test Description	Analytical Method Reference(Based On)
FE-TOT-LOW-ICP-VA	Water	Total Fe in Water by ICPOES	EPA SW-846 3005A/6010B
This analysis is carried out using procedures adapted from "Standard Methods for the Examination of Water and Wastewater" published by the American Public Health Association, and with procedures adapted from "Test Methods for Evaluating Solid Waste" SW-846 published by the United States Environmental Protection Agency (EPA). The procedures may involve preliminary sample treatment by acid digestion, using either hotblock or microwave oven (EPA Method 3005A). Instrumental analysis is by inductively coupled plasma - optical emission spectrophotometry (EPA Method 6010B).			
HARDNESS-CALC-VA	Water	Hardness	APHA 2340B
Hardness is calculated from Calcium and Magnesium concentrations, and is expressed as calcium carbonate equivalents.			
HG-TOT-LOW-CVAFS-VA	Water	Total Mercury in Water by CVAFS(Low)	EPA 245.7
This analysis is carried out using procedures adapted from "Standard Methods for the Examination of Water and Wastewater" published by the American Public Health Association, and with procedures adapted from "Test Methods for Evaluating Solid Waste" SW-846 published by the United States Environmental Protection Agency (EPA). The procedure involves a cold-oxidation of the acidified sample using bromine monochloride prior to reduction of the sample with stannous chloride. Instrumental analysis is by cold vapour atomic fluorescence spectrophotometry (EPA Method 245.7).			
IONBALANCE-VA	Water	Ion Balance Calculation	APHA 1030E
Cation Sum, Anion Sum, and Ion Balance (as % difference) are calculated based on guidance from APHA Standard Methods (1030E Checking Correctness of Analysis). Because all aqueous solutions are electrically neutral, the calculated ion balance (% difference of cations minus anions) should be near-zero.			
Cation and Anion Sums are the total meq/L concentration of major cations and anions. Dissolved species are used where available. Minor ions are included where data is present. Ion Balance is calculated as:			
Ion Balance (%) = [Cation Sum-Anion Sum] / [Cation Sum+Anion Sum]			
MET-TOT-ICP-VA	Water	Total Metals in Water by ICPOES	EPA SW-846 3005A/6010B
This analysis is carried out using procedures adapted from "Standard Methods for the Examination of Water and Wastewater" published by the American Public Health Association, and with procedures adapted from "Test Methods for Evaluating Solid Waste" SW-846 published by the United States Environmental Protection Agency (EPA). The procedures may involve preliminary sample treatment by acid digestion, using either hotblock or microwave oven (EPA Method 3005A). Instrumental analysis is by inductively coupled plasma - optical emission spectrophotometry (EPA Method 6010B).			
MET-TOT-LOW-MS-VA	Water	Total Metals in Water by ICPMS(Low)	EPA SW-846 3005A/6020A
This analysis is carried out using procedures adapted from "Standard Methods for the Examination of Water and Wastewater" published by the American Public Health Association, and with procedures adapted from "Test Methods for Evaluating Solid Waste" SW-846 published by the United States Environmental Protection Agency (EPA). The procedures may involve preliminary sample treatment by acid digestion, using either hotblock or microwave oven, or filtration (EPA Method 3005A). Instrumental analysis is by inductively coupled plasma - mass spectrometry (EPA Method 6020A).			
MET-TOT-ULTRA-MS-VA	Water	Total Metals in Water by ICPMS (Ultra)	EPA SW-846 3005A/6020A
This analysis is carried out using procedures adapted from "Standard Methods for the Examination of Water and Wastewater" published by the American Public Health Association, and with procedures adapted from "Test Methods for Evaluating Solid Waste" SW-846 published by the United States Environmental Protection Agency (EPA). The procedures may involve preliminary sample treatment by acid digestion, using either hotblock or microwave oven, or filtration (EPA Method 3005A). Instrumental analysis is by inductively coupled plasma - mass spectrometry (EPA Method 6020A).			
N-TOT-COMBUST-VA	Water	Total Nitrogen by Combustion	ASTM D5176-91, EN12260 (EU STD Method)
This analysis is carried out using procedures adapted from ASTM Method D 5176-91 "Standard Test Method for Total Chemically Bound Nitrogen in Water by Pyrolysis and Chemiluminescence detection." Total Nitrogen is determined directly by pyrolysis with chemiluminescence detection using automated instrumentation. Total Kjeldahl Nitrogen is determined by calculation.			
NH3-COL-VA	Water	Ammonia by Color	APHA 4500-NH3 "Nitrogen (Ammonia)"
This analysis is carried out, on unpreserved samples, using procedures adapted from APHA Method 4500-NH3 "Nitrogen (Ammonia)". Ammonia is determined using the phenate colourimetric method.			

Reference Information

Methods Listed (if applicable):

ALS Test Code	Matrix	Test Description	Analytical Method Reference(Based On)
PH-MAN-VA	Water	pH by Manual Meter	APHA 4500-H "pH Value"
This analysis is carried out using procedures adapted from APHA Method 4500-H "pH Value". The pH is determined in the laboratory using a pH electrode.			
PH-PCT-VA	Water	pH by Meter (Automated)	APHA 4500-H "pH Value"
This analysis is carried out using procedures adapted from APHA Method 4500-H "pH Value". The pH is determined in the laboratory using a pH electrode			
PO4-DO-COL-VA	Water	Dissolved ortho Phosphate by Color	APHA 4500-P "Phosphorous"
This analysis is carried out using procedures adapted from APHA Method 4500-P "Phosphorus". All forms of phosphate are determined by the ascorbic acid colourimetric method. Dissolved ortho-phosphate (dissolved reactive phosphorous) is determined by direct measurement. Total phosphate (total phosphorous) is determined after persulphate digestion of a sample. Total dissolved phosphate (total dissolved phosphorous) is determined by filtering a sample through a 0.45 micron membrane filter followed by persulfate digestion of the filtrate.			
PO4-T-COL-VA	Water	Total Phosphate P by Color	APHA 4500-P "Phosphorous"
This analysis is carried out using procedures adapted from APHA Method 4500-P "Phosphorus". All forms of phosphate are determined by the ascorbic acid colourimetric method. Dissolved ortho-phosphate (dissolved reactive phosphorous) is determined by direct measurement. Total phosphate (total phosphorous) is determined after persulphate digestion of a sample. Total dissolved phosphate (total dissolved phosphorous) is determined by filtering a sample through a 0.45 micron membrane filter followed by persulfate digestion of the filtrate.			
TDS-CALC-VA	Water	TDS (Calculation from EC)	APHA 1030E (20TH EDITION)
This analysis is carried out using procedures adapted from APHA 1030E "Checking Correctness of Analyses".			
TKN-CALC-VA	Water	TKN by Calculation via TN combustion	BC MOE LABORATORY MANUAL (2005)
This analysis is carried out using procedures adapted from ASTM Method D 5176-91 "Standard Test Method for Total Chemically Bound Nitrogen in Water by Pyrolysis and Chemiluminescence detection." Total Nitrogen is determined directly by pyrolysis with chemiluminescence detection using automated instrumentation. Total Kjeldahl Nitrogen is determined by calculation.			
TSS-VA	Water	Solids by Gravimetric	APHA 2540 Gravimetric
This analysis is carried out using procedures adapted from APHA Method 2540 "Solids". Solids are determined gravimetrically. Total suspended solids (TSS) are determined by filtering a sample through a glass fibre filter, TSS is determined by drying the filter at 104 degrees celsius.			
TURBIDITY-VA	Water	Turbidity by Meter	APHA 2130 "Turbidity"
This analysis is carried out using procedures adapted from APHA Method 2130 "Turbidity". Turbidity is determined by the nephelometric method.			
<p>** Laboratory Methods employed follow in-house procedures, which are generally based on nationally or internationally accepted methodologies.</p> <p>The last two letters of the above ALS Test Code column indicate the laboratory that performed analytical analysis for that test. Refer to the list below:</p>			
Laboratory Definition Code	Laboratory Location	Laboratory Definition Code	Laboratory Location
VA	ALS LABORATORY GROUP - VANCOUVER, BC, CANADA		

Reference Information

Methods Listed (if applicable):

ALS Test Code	Matrix	Test Description	Analytical Method Reference(Based On)
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GLOSSARY OF REPORT TERMS

Surr - A surrogate is an organic compound that is similar to the target analyte(s) in chemical composition and behavior but not normally detected in environmental samples. Prior to sample processing, samples are fortified with one or more surrogate compounds.

The reported surrogate recovery value provides a measure of method efficiency.

mg/kg (units) - unit of concentration based on mass, parts per million

mg/L (units) - unit of concentration based on volume, parts per million

N/A - Result not available. Refer to qualifier code and definition for explanation

Test results reported relate only to the samples as received by the laboratory.

UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.

Although test results are generated under strict QA/QC protocols, any unsigned test reports, faxes, or emails are considered preliminary.

ALS Laboratory Group has an extensive QA/QC program where all analytical data reported is analyzed using approved referenced procedures followed by checks and reviews by senior managers and quality assurance personnel. However, since the results are obtained from chemical measurements and thus cannot be guaranteed, ALS Laboratory Group assumes no liability for the use or interpretation of the results.

ALS Environmental

excellence in analytical testing



BHP
S.O. 33780

1988 Triumph Street, Vancouver, BC V5L 1K5

Tel: 604-253-4188 Toll Free: 1-800-665-0243 Fax: 604-253-6700

ALS Contact: Can Dang

Form 10971

BHP Billiton Diamonds Inc.

1102 4920 52nd Street, Yellowknife, NT X1A 3T1

Tel: 867-880-2157 Fax: 867-880-4012

BHP Contacts: Sarah Baines / Richard Ehler



CHAIN OF CUSTODY FORM

For Lab Use																			
Station ID	Matrix	Date	Time	Init		AEMP-Nutrients/Organics	AEMP-Physical/Chemical Parameters	AEMP-Total Metals	Fluoride										
AQ-102		Snow	4/19/2008	3:40:00 PM	W	1	1	1	1	BHP2									
AQ-109		Snow	4/19/2008	11:50:00 A	W	1	1	1	1	BHP2									
AQ-114		Snow	4/18/2008	3:18:00 PM	W	1	1	1	1	BHP2									
AQ-108		Snow	4/19/2008	9:47:00 AM	W	1	1	1	1	BHP2									
AQ-107		Snow	4/20/2008	11:50:00 A	W	1	1	1	1	BHP2									
AQ-110		Snow	4/18/2008	11:04:00 A	W	1	1	1	1	BHP2									
AQ-111		Snow	4/18/2008	1:04:00 PM	W	1	1	1	1	BHP2									
AQ-112		Snow	4/18/2008	2:18:00 PM	W	1	1	1	1	BHP2									
AQ-103		Snow	4/20/2008	4:45:00 PM	W	1	1	1	1	BHP2									
AQ-105		Snow	4/19/2008	4:40:00 PM	W	1	1	1	1	BHP2									
AQ-114	F1	Snow	4/18/2008	3:25:00 PM	W	1	1	1	1	BHP2									
AQ-55-SNOW		Snow	4/16/2008	12:45:00 P	W	1	1	1	1	BHP2									
AQ-113		Snow	4/19/2008	1:50:00 PM	W	1	1	1	1	BHP2									
AQ-106		Snow	4/20/2008	1:17:00 PM	W	1	1	1	1	BHP2									
AQ-02-SNOW		Snow	4/21/2008	10:20:00 A	RE	1	1	1	1	BHP2									
AQ-02		Snow	4/21/2008	11:20:00 A	RE	1	1	1	1	BHP2									
AQ-31		Snow	4/21/2008	10:20:00 A	RE	1	1	1	1	BHP2									
AQ-06		Snow	4/21/2008	3:03:00 PM	RE	1	1	1	1	BHP2									
AQ-05		Snow	4/21/2008	2:07:00 PM	RE	1	1	1	1	BHP2									
AQ-04		Snow	4/21/2008	1:19:00 PM	RE	1	1	1	1	BHP2									

Turn around Required: Regular 2-week

Special Instructions (Billing details, QC reporting, etc):

Billing Code: BHP2501

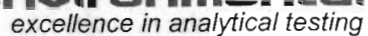
AQ-02 and AQ-55 sent to lab as snow sample. Samples will need to be melted down and analyzed as per coc 10971

Relinquished by:	Date	Received by:	Date
	Time	HD	08/04/29
Relinquished by:	Date	Received by:	Date
	Time		12:19

FOR LAB USE ONLY			
Cooler seal intact upon receipt?		Sample temperature upon receipt: 12 C.	
<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No	<input type="checkbox"/> N/A	
Frozen?		<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No

Send Analytical Results to:

compliance.team@bhpbilliton.com



ALS Contact: Can Dang

BHP Contacts: Sarah Baines / Richard Ehlert

[illegible]

For Lab Use

FOR LAB USE ONLY

AQ-02 and AQ-55 sent to lab as snow sample. Samples will need to be melted down and analyzed as per coc 10971

FOR LAB USE ONLY

Frozen? ☐ Yes ☒ No

Send Analytical Results to:
compliance.team@bhpbilliton.com

Appendix 6

Lichen Lab Analysis Data

Appendix 6. Lichen Lab Analysis Data
2008 Chemical Analysis of Lichen Tissue

Station Name	AQ-105 CC2	AQ-105 CC3	AQ-105 PE1	AQ-101 CC4	AQ-101 CC1	AQ-101 PE1	AQ-44 CC1	AQ-33 CC2	AQ-2 CC2
Date sent to Lab	29-DEC-08	29-DEC-08	29-DEC-08	29-DEC-08	29-DEC-08	29-DEC-08	29-DEC-08	29-DEC-08	29-DEC-08
Time Sampled	16:24	16:27	16:29	16:32	16:33	16:35	16:41	16:48	16:54
ALS Sample ID	L723635-1	L723635-2	L723635-3	L723635-4	L723635-5	L723635-6	L723635-7	L723635-8	L723635-9
Anions and Nutrients									
Total Nitrogen by Leco	0.44	0.46	2.52	0.35	0.49	2.70	0.49	0.48	0.55
Sulfate	263	258	1040	281	286	502	266	269	268
Metals									
Aluminum (Al)-Total	190	214	377	102	92	676	120	126	664
Antimony (Sb)-Total	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Arsenic (As)-Total	0.252	0.270	0.710	0.571	0.524	2.14	0.285	0.278	0.277
Barium (Ba)-Total	20.3	21.4	26.9	12.6	11.8	30.9	17.3	16.6	32.5
Beryllium (Be)-Total	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30
Bismuth (Bi)-Total	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30
Cadmium (Cd)-Total	0.054	0.051	0.109	0.045	0.042	0.084	0.051	0.050	0.078
Calcium (Ca)-Total	1340	1310	2320	1140	1110	1860	1120	1100	2110
Chromium (Cr)-Total	1.08	1.17	1.85	0.61	0.53	1.86	2.50	2.68	12.8
Cobalt (Co)-Total	0.19	0.21	1.06	0.23	0.21	1.01	0.13	0.13	0.66
Copper (Cu)-Total	3.63	3.79	8.15	1.34	1.32	6.00	0.882	0.888	3.05
Lead (Pb)-Total	0.54	0.57	0.43	0.29	0.27	0.63	0.36	0.35	0.72
Lithium (Li)-Total	<0.50	<0.50	0.62	<0.50	<0.50	1.06	<0.50	<0.50	0.79
Magnesium (Mg)-Total	631	642	927	601	555	942	473	465	1150
Manganese (Mn)-Total	87.9	88.7	174	124	113	134	46.6	45.6	96.9
Mercury (Hg)-Total	0.0340	0.0440	0.0887	0.0458	0.0408	0.0994	0.0416	0.0395	0.0581
Molybdenum (Mo)-Total	<0.050	0.052	0.105	<0.050	<0.050	0.084	<0.050	<0.050	0.251
Nickel (Ni)-Total	0.96	1.06	3.78	0.58	0.50	4.12	1.25	1.35	7.08
Selenium (Se)-Total	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Strontium (Sr)-Total	7.08	7.10	9.75	4.34	4.28	10.1	7.37	7.12	13.7
Sulfur (S)-Total	352	339	1720	299	305	1120	303	295	385
Thallium (Tl)-Total	<0.030	<0.030	0.033	0.031	<0.030	0.072	<0.030	<0.030	0.038
Tin (Sn)-Total	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Uranium (U)-Total	0.031	0.034	0.145	0.022	0.020	0.259	0.023	0.021	0.096
Vanadium (V)-Total	<0.50	<0.50	1.02	<0.50	<0.50	1.68	<0.50	<0.50	1.72
Zinc (Zn)-Total	36.6	37.9	55.4	38.3	35.1	40.6	32.8	33.2	41.8

Appendix 6. Lichen Lab Analysis Data
2008 Chemical Analysis of Lichen Tissue

Station Name	AQ-2 CC1	AQ-107 PE1	AQ-109 CC1	AQ-109 CC2	AQ-C2 CC2	AQ-C2 CC3	AQ-C2 PE2	AQ-114 CC3	AQ-114 CC4
Date sent to Lab	29-DEC-08	29-DEC-08	30-DEC-08	30-DEC-08	30-DEC-08	30-DEC-08	30-DEC-08	30-DEC-08	30-DEC-08
Time Sampled	16:55	17:17	11:08	11:10	11:13	11:14	11:15	11:18	11:19
ALS Sample ID	L723635-10	L723635-11	L723635-12	L723635-13	L723635-14	L723635-15	L723635-16	L723635-17	L723635-18
Anions and Nutrients									
Total Nitrogen by Leco	0.64	2.62	0.52	0.52	0.57	0.47	2.26	0.44	0.51
Sulfate	273	893	447	401	370	325	374	357	349
Metals									
Aluminum (Al)-Total	500	259	226	255	247	247	428	286	278
Antimony (Sb)-Total	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Arsenic (As)-Total	0.207	0.612	0.269	0.298	0.172	0.183	0.383	0.278	0.283
Barium (Ba)-Total	24.2	27.7	15.3	16.1	23.7	23.6	27.9	22.2	21.7
Beryllium (Be)-Total	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30
Bismuth (Bi)-Total	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30
Cadmium (Cd)-Total	0.077	0.091	0.046	0.046	0.063	0.095	0.058	0.062	0.073
Calcium (Ca)-Total	1680	1900	1550	1700	1480	1560	1350	1580	1470
Chromium (Cr)-Total	9.84	1.17	1.60	1.86	2.29	2.09	1.97	2.91	2.70
Cobalt (Co)-Total	0.49	0.85	0.35	0.37	0.32	0.31	0.82	0.63	0.62
Copper (Cu)-Total	2.34	7.34	6.19	6.47	2.26	2.08	6.11	6.84	7.39
Lead (Pb)-Total	0.55	0.35	0.78	0.81	0.51	0.48	0.45	0.95	1.03
Lithium (Li)-Total	0.58	<0.50	<0.50	<0.50	<0.50	<0.50	0.58	<0.50	<0.50
Magnesium (Mg)-Total	899	745	688	738	644	672	843	791	776
Manganese (Mn)-Total	75.9	144	118	127	104	114	190	101	96.5
Mercury (Hg)-Total	0.0410	0.0735	0.0390	0.0416	0.0507	0.0498	0.0637	0.0423	0.0397
Molybdenum (Mo)-Total	0.175	0.092	0.063	0.065	0.079	0.079	0.205	0.090	0.106
Nickel (Ni)-Total	5.49	2.76	1.70	1.88	2.07	2.05	3.39	3.66	3.55
Selenium (Se)-Total	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Strontium (Sr)-Total	11.1	9.16	6.11	6.44	7.72	7.79	7.41	9.34	9.17
Sulfur (S)-Total	381	1690	339	348	362	332	851	340	340
Thallium (Tl)-Total	<0.030	0.032	<0.030	<0.030	0.032	<0.030	0.051	0.034	0.035
Tin (Sn)-Total	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Uranium (U)-Total	0.073	0.098	0.040	0.043	0.062	0.055	0.161	0.045	0.045
Vanadium (V)-Total	1.24	0.70	0.58	0.65	0.56	0.53	1.16	0.71	0.81
Zinc (Zn)-Total	33.9	50.4	34.0	36.8	33.3	35.4	49.6	33.5	32.2

Appendix 6. Lichen Lab Analysis Data
2008 Chemical Analysis of Lichen Tissue

Station Name	AQ-114 PE1	AQ-115 CC1	AQ-115 CC3	AQ-115 PE1	AQ-31 CC1	AQ-31 CC2	AQ-31 PE1	AQ-32 CC3	AQ-32 CC4
Date sent to Lab	30-DEC-08	30-DEC-08	30-DEC-08	30-DEC-08	30-DEC-08	30-DEC-08	30-DEC-08	30-DEC-08	30-DEC-08
Time Sampled	11:21	11:24	11:25	11:26	11:29	11:29	11:30	11:32	11:34
ALS Sample ID	L723635-19	L723635-20	L723635-21	L723635-22	L723635-23	L723635-24	L723635-25	L723635-26	L723635-27
Anions and Nutrients									
Total Nitrogen by Leco	2.32	0.51	0.52	2.60	0.57	0.56	2.68	0.40	0.45
Sulfate	253	353	347	505	449	496	967	377	412
Metals									
Aluminum (Al)-Total	300	173	276	376	831	839	2280	205	181
Antimony (Sb)-Total	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Arsenic (As)-Total	0.268	0.208	0.301	0.402	0.314	0.315	1.18	0.240	0.242
Barium (Ba)-Total	47.1	22.3	27.0	37.4	32.9	33.3	76.8	12.8	12.5
Beryllium (Be)-Total	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30
Bismuth (Bi)-Total	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30
Cadmium (Cd)-Total	0.048	0.040	0.047	0.054	0.072	0.066	0.132	0.036	0.048
Calcium (Ca)-Total	2170	1550	1660	2260	4160	4130	2780	1500	1560
Chromium (Cr)-Total	1.56	1.06	1.37	1.18	8.45	8.47	18.0	5.06	4.30
Cobalt (Co)-Total	0.79	0.30	0.37	1.00	1.13	1.16	3.83	0.27	0.27
Copper (Cu)-Total	7.11	1.63	2.08	5.87	4.29	4.74	11.8	1.11	1.10
Lead (Pb)-Total	0.81	0.32	0.43	0.75	0.90	0.90	1.17	0.23	0.22
Lithium (Li)-Total	<0.50	<0.50	<0.50	<0.50	1.30	1.31	3.47	<0.50	<0.50
Magnesium (Mg)-Total	806	586	617	1020	2110	2170	5070	566	574
Manganese (Mn)-Total	224	108	112	149	117	118	162	93.0	101
Mercury (Hg)-Total	0.0863	0.0498	0.0457	0.108	0.0576	0.0513	0.0745	0.0488	0.0564
Molybdenum (Mo)-Total	0.100	<0.050	0.059	<0.050	0.273	0.267	0.567	0.066	0.067
Nickel (Ni)-Total	5.17	1.56	1.99	7.06	12.2	12.5	33.9	2.26	2.03
Selenium (Se)-Total	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Strontium (Sr)-Total	9.12	7.60	8.43	11.9	20.2	19.9	28.5	4.77	4.68
Sulfur (S)-Total	792	388	409	1110	424	437	1520	342	327
Thallium (Tl)-Total	0.107	0.038	0.043	0.034	0.054	0.053	0.058	<0.030	<0.030
Tin (Sn)-Total	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Uranium (U)-Total	0.054	0.026	0.038	0.062	0.122	0.122	0.409	0.040	0.033
Vanadium (V)-Total	0.82	<0.50	0.61	0.91	2.49	2.55	7.18	<0.50	<0.50
Zinc (Zn)-Total	33.7	32.4	32.1	64.5	26.8	27.5	57.3	35.3	36.9

Appendix 6. Lichen Lab Analysis Data
2008 Chemical Analysis of Lichen Tissue

Station Name	AQ-32 PE1	AQ-54 CC1	AQ-54 CC3	AQ-54 PE2	AQ-49 CC2	AQ-49 CC4	AQ-49 PE1	AQ-123 CC3	AQ-123 CC4
Date sent to Lab	30-DEC-08	30-DEC-08	30-DEC-08	30-DEC-08	30-DEC-08	30-DEC-08	30-DEC-08	30-DEC-08	30-DEC-08
Time Sampled	11:35	11:38	11:39	11:40	11:43	11:46	11:47	11:50	11:51
ALS Sample ID	L723635-28	L723635-29	L723635-30	L723635-31	L723635-32	L723635-33	L723635-34	L723635-35	L723635-36
Anions and Nutrients									
Total Nitrogen by Leco	2.94	0.45	0.47	2.22	0.50	0.46	2.37	0.49	0.51
Sulfate	1130	319	293	458	359	326	326	414	413
Metals									
Aluminum (Al)-Total	686	107	120	280	187	177	483	208	253
Antimony (Sb)-Total	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Arsenic (As)-Total	0.512	0.113	0.132	0.366	0.177	0.177	0.400	0.233	0.290
Barium (Ba)-Total	49.4	18.6	18.3	34.0	27.1	23.5	34.4	15.0	14.9
Beryllium (Be)-Total	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30
Bismuth (Bi)-Total	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30
Cadmium (Cd)-Total	0.105	0.042	0.036	0.071	0.047	0.059	0.059	0.032	0.040
Calcium (Ca)-Total	1600	1150	1070	1390	2020	1940	1680	1350	1390
Chromium (Cr)-Total	6.65	0.74	0.84	0.72	3.67	4.26	3.31	2.00	1.98
Cobalt (Co)-Total	1.56	0.27	0.29	0.91	0.27	0.27	0.73	0.46	0.56
Copper (Cu)-Total	9.38	1.87	2.19	5.54	1.33	1.24	6.09	4.01	6.25
Lead (Pb)-Total	0.55	0.31	0.36	0.54	0.30	0.26	0.68	0.46	0.64
Lithium (Li)-Total	1.15	<0.50	<0.50	<0.50	<0.50	<0.50	0.58	<0.50	<0.50
Magnesium (Mg)-Total	2370	431	418	642	807	792	1010	770	873
Manganese (Mn)-Total	133	83.3	77.7	90.4	149	137	195	145	147
Mercury (Hg)-Total	0.0501	0.0333	0.0391	0.0915	0.0523	0.0397	0.0838	0.0494	0.0580
Molybdenum (Mo)-Total	0.469	<0.050	<0.050	0.108	0.065	0.076	0.173	0.068	0.068
Nickel (Ni)-Total	13.2	1.14	1.23	3.95	2.53	2.82	4.52	1.68	1.87
Selenium (Se)-Total	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Strontium (Sr)-Total	20.3	4.98	4.70	9.75	8.31	7.69	9.85	3.76	4.29
Sulfur (S)-Total	1460	313	318	941	360	332	847	398	402
Thallium (Tl)-Total	0.035	<0.030	<0.030	0.060	0.033	<0.030	0.052	0.032	<0.030
Tin (Sn)-Total	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Uranium (U)-Total	0.136	0.015	0.018	0.035	0.033	0.026	0.243	0.049	0.061
Vanadium (V)-Total	2.38	<0.50	<0.50	0.58	<0.50	<0.50	1.21	<0.50	0.62
Zinc (Zn)-Total	42.9	26.4	24.8	62.8	38.5	35.8	48.9	30.7	43.0

Appendix 6. Lichen Lab Analysis Data
2008 Chemical Analysis of Lichen Tissue

Station Name	AQ-123 PE1	AQ-116 CC2	AQ-116 CC4	AQ-116 PE1	AQ-108 CC1	AQ-108 CC2	AQ-108 PE1	AQ-108 CC3	AQ-108 CC6
Date sent to Lab	30-DEC-08	30-DEC-08	30-DEC-08	30-DEC-08	30-DEC-08	30-DEC-08	30-DEC-08	30-DEC-08	30-DEC-08
Time Sampled	11:53	11:55	11:56	11:57	12:00	12:01	12:02	12:07	12:08
ALS Sample ID	L723635-37	L723635-38	L723635-39	L723635-40	L723635-41	L723635-42	L723635-43	L723635-44	L723635-45
Anions and Nutrients									
Total Nitrogen by Leco	2.49	0.46	0.50	2.65	0.42	0.56	2.90	0.49	0.54
Sulfate	799	308	402	984	329	381	960	417	355
Metals									
Aluminum (Al)-Total	171	148	153	2050	53	202	825	197	282
Antimony (Sb)-Total	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Arsenic (As)-Total	0.274	0.312	0.330	1.29	<0.050	0.160	0.498	0.210	0.269
Barium (Ba)-Total	31.3	17.8	18.4	81.6	7.38	22.1	43.6	17.0	18.7
Beryllium (Be)-Total	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30
Bismuth (Bi)-Total	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30
Cadmium (Cd)-Total	<0.030	0.045	0.047	0.131	<0.030	0.066	0.110	0.049	0.054
Calcium (Ca)-Total	2330	1340	1350	2640	578	2170	1650	1500	1690
Chromium (Cr)-Total	1.38	1.12	1.15	16.4	<0.50	1.00	7.92	1.15	1.55
Cobalt (Co)-Total	0.39	0.17	0.17	3.83	<0.10	0.23	1.62	0.22	0.26
Copper (Cu)-Total	5.36	2.18	2.21	12.0	0.999	3.63	10.1	1.35	1.87
Lead (Pb)-Total	0.28	0.40	0.40	1.18	0.13	0.47	0.58	0.27	0.37
Lithium (Li)-Total	<0.50	<0.50	<0.50	3.58	<0.50	<0.50	1.18	<0.50	<0.50
Magnesium (Mg)-Total	856	572	555	5010	191	716	2570	811	858
Manganese (Mn)-Total	203	58.7	57.1	155	25.3	92.0	129	90.1	95.6
Mercury (Hg)-Total	0.0549	0.0377	0.0398	0.0814	0.0447	0.0415	0.0578	0.0384	0.0553
Molybdenum (Mo)-Total	0.063	<0.050	<0.050	0.605	<0.050	0.053	0.509	0.055	0.060
Nickel (Ni)-Total	2.00	0.90	0.87	35.7	<0.50	1.36	14.3	1.33	1.68
Selenium (Se)-Total	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Strontium (Sr)-Total	5.70	7.82	7.81	29.7	2.90	10.1	17.3	7.37	8.12
Sulfur (S)-Total	1260	311	329	1570	410	438	1530	354	395
Thallium (Tl)-Total	0.081	<0.030	<0.030	0.057	<0.030	<0.030	0.038	<0.030	0.035
Tin (Sn)-Total	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Uranium (U)-Total	0.038	0.024	0.026	0.430	<0.010	0.038	0.155	0.026	0.039
Vanadium (V)-Total	0.51	<0.50	<0.50	6.54	<0.50	<0.50	2.72	<0.50	0.66
Zinc (Zn)-Total	35.2	38.8	38.1	56.1	11.1	39.4	45.4	39.9	42.6

Appendix 6. Lichen Lab Analysis Data
2008 Chemical Analysis of Lichen Tissue

Station Name	AQ-113 CC1	AQ-113 CC2	AQ-19 CC3	AQ-19 CC4	AQ-29 CC5	AQ-29 CC6	AQ-29 PE1	AQ-104 CC2	AQ-104 CC3
Date sent to Lab	30-DEC-08	30-DEC-08	30-DEC-08	30-DEC-08	30-DEC-08	30-DEC-08	30-DEC-08	30-DEC-08	30-DEC-08
Time Sampled	12:10	12:11	12:15	12:16	12:20	12:22	12:23	12:29	12:30
ALS Sample ID	L723635-46	L723635-47	L723635-48	L723635-49	L723635-50	L723635-51	L723635-52	L723635-53	L723635-54
Anions and Nutrients									
Total Nitrogen by Leco	0.44	0.43	0.53	0.53	0.51	0.52	2.84	0.61	0.57
Sulfate	412	396	455	420	392	511	1430	387	392
Metals									
Aluminum (Al)-Total	486	566	856	901	1210	1370	3140	210	220
Antimony (Sb)-Total	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Arsenic (As)-Total	0.254	0.298	0.300	0.300	0.288	0.316	0.792	0.214	0.217
Barium (Ba)-Total	19.2	21.5	25.2	25.6	47.1	51.9	68.7	20.9	21.6
Beryllium (Be)-Total	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30
Bismuth (Bi)-Total	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30
Cadmium (Cd)-Total	0.039	0.043	0.050	0.050	0.077	0.078	0.071	0.072	0.072
Calcium (Ca)-Total	1550	1650	2850	2820	4330	4280	2090	2430	2400
Chromium (Cr)-Total	9.86	11.9	8.14	6.92	9.85	10.4	16.5	1.58	1.66
Cobalt (Co)-Total	0.50	0.59	0.86	0.83	1.35	1.53	3.43	0.45	0.46
Copper (Cu)-Total	1.59	1.94	3.65	3.76	4.36	5.05	18.5	3.61	4.18
Lead (Pb)-Total	0.48	0.58	0.67	0.67	1.14	1.28	1.24	0.62	0.67
Lithium (Li)-Total	0.56	0.70	1.32	1.25	1.83	2.07	5.23	<0.50	<0.50
Magnesium (Mg)-Total	889	1010	1440	1430	2000	2120	4250	669	682
Manganese (Mn)-Total	90.7	103	97.0	96.7	86.7	92.9	68.9	130	132
Mercury (Hg)-Total	0.0469	0.0579	0.0538	0.0541	0.0501	0.0521	0.0508	0.0419	0.0513
Molybdenum (Mo)-Total	0.164	0.193	0.224	0.203	0.266	0.322	0.976	0.080	0.092
Nickel (Ni)-Total	6.89	7.94	7.01	6.48	13.3	14.8	25.2	1.49	1.54
Selenium (Se)-Total	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Strontium (Sr)-Total	6.83	7.52	11.2	11.9	20.8	21.5	26.8	7.98	8.08
Sulfur (S)-Total	338	340	425	427	452	465	1850	380	359
Thallium (Tl)-Total	0.058	0.062	0.063	0.058	0.059	0.066	0.078	<0.030	<0.030
Tin (Sn)-Total	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Uranium (U)-Total	0.068	0.082	0.117	0.118	0.192	0.222	0.388	0.049	0.054
Vanadium (V)-Total	1.24	1.51	2.55	2.49	3.48	3.94	9.42	<0.50	<0.50
Zinc (Zn)-Total	30.1	33.3	40.1	39.7	25.9	28.1	45.1	37.5	38.2

Appendix 6. Lichen Lab Analysis Data
2008 Chemical Analysis of Lichen Tissue

Station Name	AQ-104 PE2	AQ-6-1 CC1	AQ-6-1 CC2	AQ-6-1 PE1	AQ-6-2 CC1	AQ-6-2 CC2	AQ-06-2 PE1	AQ-35 CC2	AQ-35 CC4
Date sent to Lab	30-DEC-08	30-DEC-08	30-DEC-08	30-DEC-08	30-DEC-08	30-DEC-08	30-DEC-08	30-DEC-08	30-DEC-08
Time Sampled	12:31	12:34	12:35	12:36	12:41	12:42	12:43	12:46	12:47
ALS Sample ID	L723635-55	L723635-56	L723635-57	L723635-58	L723635-59	L723635-60	L723635-61	L723635-62	L723635-63
Anions and Nutrients									
Total Nitrogen by Leco	2.10	0.57	0.57	2.97	0.61	0.61	2.75	0.39	0.49
Sulfate	444	442	433	1070	431	447	1040	364	462
Metals									
Aluminum (Al)-Total	627	116	278	787	938	783	2060	217	224
Antimony (Sb)-Total	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Arsenic (As)-Total	0.720	0.231	0.238	0.503	0.356	0.301	0.720	0.207	0.215
Barium (Ba)-Total	39.7	8.59	14.9	44.2	34.3	29.2	62.4	18.8	19.6
Beryllium (Be)-Total	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30
Bismuth (Bi)-Total	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30
Cadmium (Cd)-Total	0.091	0.055	0.059	0.109	0.104	0.081	0.165	0.064	0.064
Calcium (Ca)-Total	2800	1630	2110	1660	5120	4270	3800	1520	1460
Chromium (Cr)-Total	1.84	0.84	2.49	7.44	12.1	10.0	22.7	1.53	1.45
Cobalt (Co)-Total	1.44	0.44	0.60	1.56	0.99	0.85	2.28	0.18	0.17
Copper (Cu)-Total	7.67	2.39	2.73	10.2	2.94	2.69	9.17	3.47	2.70
Lead (Pb)-Total	1.23	0.28	0.37	0.55	0.78	0.72	1.21	0.53	0.52
Lithium (Li)-Total	0.82	<0.50	<0.50	1.15	1.14	0.91	2.51	<0.50	<0.50
Magnesium (Mg)-Total	984	841	1180	2420	1910	1510	3530	687	683
Manganese (Mn)-Total	156	183	167	125	121	96.9	291	65.4	65.1
Mercury (Hg)-Total	0.137	0.0397	0.0352	0.0545	0.0578	0.0593	0.129	0.0501	0.0462
Molybdenum (Mo)-Total	0.167	<0.050	0.094	0.455	0.270	0.239	0.629	0.073	0.062
Nickel (Ni)-Total	4.34	0.89	3.26	14.0	11.9	10.1	25.9	1.42	1.33
Selenium (Se)-Total	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Strontium (Sr)-Total	13.7	3.73	6.63	17.5	16.1	15.8	19.6	8.01	8.11
Sulfur (S)-Total	1010	366	376	1430	488	434	1530	355	643
Thallium (Tl)-Total	0.069	<0.030	<0.030	0.036	0.047	0.038	0.055	<0.030	<0.030
Tin (Sn)-Total	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Uranium (U)-Total	0.359	0.028	0.049	0.140	0.117	0.106	0.229	0.030	0.037
Vanadium (V)-Total	2.09	<0.50	0.72	2.66	2.64	2.13	6.59	0.52	<0.50
Zinc (Zn)-Total	58.3	38.8	36.9	47.2	32.3	28.3	44.9	42.5	41.8

Appendix 6. Lichen Lab Analysis Data
2008 Chemical Analysis of Lichen Tissue

Station Name	AQ-103 CC1	AQ-103 CC2	AQ-55 CC5	AQ-55 CC6	AQ-55 PE1	AQ-112 CC2	AQ-112 CC4	AQ-C5-CC1	AQ-C5-CC2
Date sent to Lab	30-DEC-08	30-DEC-08	30-DEC-08	30-DEC-08	30-DEC-08	30-DEC-08	30-DEC-08	30-DEC-08	30-DEC-08
Time Sampled	12:51	12:51	12:56	12:56	12:56	13:00	13:01	13:30	13:30
ALS Sample ID	L723635-64	L723635-65	L723635-66	L723635-67	L723635-68	L723635-69	L723635-70	L723635-71	L723635-72
Anions and Nutrients									
Total Nitrogen by Leco	0.40	0.42	0.49	0.45	2.50	0.42	0.34	0.33	0.36
Sulfate	363	398	681	408	322	411	408	529	414
Metals									
Aluminum (Al)-Total	245	283	191	139	317	376	310	361	411
Antimony (Sb)-Total	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Arsenic (As)-Total	0.213	0.244	0.125	0.110	0.292	0.197	0.192	0.274	0.309
Barium (Ba)-Total	12.7	13.8	14.3	12.2	15.1	21.5	19.7	24.4	27.4
Beryllium (Be)-Total	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30
Bismuth (Bi)-Total	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30
Cadmium (Cd)-Total	0.040	0.035	0.036	0.040	0.111	0.041	0.039	0.087	0.092
Calcium (Ca)-Total	1280	1180	1360	1510	1640	2000	1790	2440	2490
Chromium (Cr)-Total	1.60	2.01	1.01	0.82	1.17	7.23	8.76	1.63	2.17
Cobalt (Co)-Total	0.22	0.23	0.15	0.16	0.70	0.38	0.33	0.62	0.74
Copper (Cu)-Total	1.36	2.07	1.35	1.14	4.83	1.78	1.49	2.90	3.53
Lead (Pb)-Total	0.30	0.38	0.27	0.21	0.20	0.42	0.41	0.61	0.75
Lithium (Li)-Total	<0.50	<0.50	<0.50	<0.50	<0.50	0.56	<0.50	0.76	0.85
Magnesium (Mg)-Total	646	663	645	696	1070	814	701	752	804
Manganese (Mn)-Total	77.6	82.1	144	149	69.0	127	93.5	142	148
Mercury (Hg)-Total	0.0566	0.0583	0.0441	0.0323	0.134	0.0693	0.0517	0.0564	0.0687
Molybdenum (Mo)-Total	0.089	0.073	0.073	0.067	0.108	0.107	0.122	0.075	0.087
Nickel (Ni)-Total	1.34	1.45	0.70	0.61	2.24	4.13	4.70	2.16	2.48
Selenium (Se)-Total	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Strontium (Sr)-Total	5.03	4.83	3.25	3.56	10.4	6.96	6.12	8.83	9.26
Sulfur (S)-Total	305	325	495	347	742	363	330	392	393
Thallium (Tl)-Total	0.037	0.037	<0.030	<0.030	0.035	0.044	0.035	0.040	0.044
Tin (Sn)-Total	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Uranium (U)-Total	0.040	0.044	0.029	0.022	0.048	0.058	0.056	0.085	0.104
Vanadium (V)-Total	0.55	0.70	<0.50	<0.50	1.14	0.90	0.77	0.68	0.81
Zinc (Zn)-Total	25.8	26.1	36.6	41.9	44.6	40.1	32.0	52.1	55.5

Appendix 6. Lichen Lab Analysis Data
2008 Chemical Analysis of Lichen Tissue

Station Name	AQ-C4-CC3	AQ-C4-CC4	AQ-C4-PE1	AQ-5 CC5	AQ-5 CC6	AQ-5 PE1	AQ-4 CC1	AQ-4 CC2	AQ-4 PE2
Date sent to Lab	30-DEC-08	30-DEC-08	30-DEC-08	30-DEC-08	30-DEC-08	30-DEC-08	30-DEC-08	30-DEC-08	30-DEC-08
Time Sampled	13:33	13:34	13:35	13:37	13:38	13:39	13:42	13:43	13:44
ALS Sample ID	L723635-73	L723635-74	L723635-75	L723635-76	L723635-77	L723635-78	L723635-79	L723635-80	L723635-81
Anions and Nutrients									
Total Nitrogen by Leco	0.32	0.34	2.15	0.37	0.42	2.41	0.43	0.42	2.53
Sulfate	377	417	579	428	439	354	415	395	459
Metals									
Aluminum (Al)-Total	131	139	916	751	805	1270	766	765	1380
Antimony (Sb)-Total	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Arsenic (As)-Total	0.444	0.481	2.37	0.256	0.264	0.470	0.275	0.262	0.500
Barium (Ba)-Total	10.7	11.3	33.4	29.6	30.8	39.5	23.6	26.0	49.8
Beryllium (Be)-Total	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30
Bismuth (Bi)-Total	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30
Cadmium (Cd)-Total	0.065	0.065	0.144	0.046	0.043	0.040	0.041	0.042	0.041
Calcium (Ca)-Total	1560	1560	4510	2380	2400	2030	1910	1990	2530
Chromium (Cr)-Total	0.80	0.96	2.89	7.11	7.87	11.4	6.49	5.05	7.30
Cobalt (Co)-Total	0.31	0.31	4.18	1.15	1.22	2.05	0.78	0.71	1.24
Copper (Cu)-Total	1.44	1.66	17.9	2.80	2.85	9.04	11.2	8.92	10.5
Lead (Pb)-Total	0.27	0.28	0.88	0.56	0.58	0.74	1.21	1.04	1.03
Lithium (Li)-Total	<0.50	<0.50	1.33	1.00	1.07	1.86	1.12	1.03	2.16
Magnesium (Mg)-Total	713	727	1980	2140	2230	3650	1380	1370	2080
Manganese (Mn)-Total	187	191	357	100	105	157	114	121	195
Mercury (Hg)-Total	0.0549	0.0449	0.0947	0.0491	0.0435	0.0616	0.0495	0.0521	0.0918
Molybdenum (Mo)-Total	<0.050	<0.050	0.568	0.195	0.203	0.419	0.179	0.179	0.287
Nickel (Ni)-Total	0.81	0.86	8.95	14.0	15.0	22.5	6.23	5.54	10.5
Selenium (Se)-Total	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Strontium (Sr)-Total	4.16	4.27	29.2	14.8	15.1	12.4	8.81	9.53	11.8
Sulfur (S)-Total	347	333	1340	388	383	858	376	375	945
Thallium (Tl)-Total	0.030	0.032	0.049	0.060	0.065	0.080	0.048	0.045	0.076
Tin (Sn)-Total	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Uranium (U)-Total	0.024	0.026	0.948	0.095	0.099	0.150	0.095	0.096	0.173
Vanadium (V)-Total	<0.50	<0.50	2.76	2.11	2.23	4.06	2.20	2.11	4.34
Zinc (Zn)-Total	30.2	30.3	52.2	26.4	27.4	32.6	37.9	38.9	37.0

Appendix 6. Lichen Lab Analysis Data
2008 Chemical Analysis of Lichen Tissue

Station Name	AQ-102 CC2	AQ-102 CC3	AQ-102 PE2	AQ-111 CC3	AQ-111 CC4	AQ-111 PE1	AQ-43 CC1	AQ-43 CC2	AQ-43 PE1
Date sent to Lab	30-DEC-08	30-DEC-08	30-DEC-08	30-DEC-08	30-DEC-08	30-DEC-08	30-DEC-08	30-DEC-08	30-DEC-08
Time Sampled	13:47	13:47	13:47	13:50	13:50	13:50	13:58	13:59	14:00
ALS Sample ID	L723635-82	L723635-83	L723635-84	L723635-85	L723635-86	L723635-87	L723635-88	L723635-89	L723635-90
Anions and Nutrients									
Total Nitrogen by Leco	0.38	0.35	2.93	0.49	0.44	2.83	0.43	0.47	2.54
Sulfate	513	541	1310	308	342	1080	521	514	1760
Metals									
Aluminum (Al)-Total	290	255	490	481	299	918	122	148	445
Antimony (Sb)-Total	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Arsenic (As)-Total	0.218	0.190	0.394	0.528	0.406	0.518	0.239	0.258	0.540
Barium (Ba)-Total	14.8	12.1	45.1	20.4	17.2	45.6	11.2	11.6	76.5
Beryllium (Be)-Total	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30
Bismuth (Bi)-Total	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30
Cadmium (Cd)-Total	0.057	0.048	0.080	0.056	0.049	0.108	0.074	0.070	0.097
Calcium (Ca)-Total	1580	1290	2110	1610	1450	1740	1730	1730	2140
Chromium (Cr)-Total	4.88	3.77	6.31	2.77	2.00	8.57	0.72	0.80	0.79
Cobalt (Co)-Total	0.41	0.37	0.98	0.46	0.36	1.70	0.59	0.60	2.81
Copper (Cu)-Total	1.54	1.34	6.82	5.16	4.08	10.3	3.51	3.85	11.3
Lead (Pb)-Total	0.33	0.29	0.34	0.65	0.50	0.62	0.40	0.43	0.41
Lithium (Li)-Total	<0.50	<0.50	0.87	0.91	<0.50	1.34	<0.50	<0.50	<0.50
Magnesium (Mg)-Total	806	776	1230	938	832	2780	823	859	1040
Manganese (Mn)-Total	113	100	107	111	101	134	184	180	154
Mercury (Hg)-Total	0.0408	0.0410	0.0471	0.0545	0.0433	0.0607	0.0432	0.0446	0.0398
Molybdenum (Mo)-Total	0.080	0.073	0.129	0.079	0.062	0.494	<0.050	<0.050	0.125
Nickel (Ni)-Total	3.23	2.57	6.79	2.68	2.09	15.3	0.93	1.01	5.25
Selenium (Se)-Total	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Strontium (Sr)-Total	5.59	4.65	23.2	8.17	7.22	17.8	5.92	6.05	49.3
Sulfur (S)-Total	387	359	1680	382	361	1470	412	445	1730
Thallium (Tl)-Total	<0.030	<0.030	0.043	<0.030	<0.030	0.036	<0.030	<0.030	<0.030
Tin (Sn)-Total	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Uranium (U)-Total	0.053	0.038	0.100	0.054	0.036	0.151	0.035	0.043	0.260
Vanadium (V)-Total	0.67	0.57	1.46	1.44	0.80	3.11	<0.50	<0.50	0.80
Zinc (Zn)-Total	35.5	34.6	69.0	44.5	40.3	46.4	34.7	35.2	47.0

Appendix 6. Lichen Lab Analysis Data
2008 Chemical Analysis of Lichen Tissue

Station Name	AQ-48 CC1	AQ-48 CC2	AQ-106 CC1	AQ-106 CC2	AQ-106 PE2	AQ-121 CC3	AQ-121 CC5	AQ-121 PE2	AQ-122 CC1
Date sent to Lab	30-DEC-08	30-DEC-08	30-DEC-08	30-DEC-08	30-DEC-08	30-DEC-08	30-DEC-08	30-DEC-08	30-DEC-08
Time Sampled	14:03	14:03	14:05	14:05	14:05	14:12	14:12	14:13	14:16
ALS Sample ID	L723635-91	L723635-92	L723635-93	L723635-94	L723635-95	L723635-96	L723635-97	L723635-98	L723635-99
Anions and Nutrients									
Total Nitrogen by Leco	0.42	0.40	0.47	0.45	2.73	0.40	0.38	2.37	0.33
Sulfate	324	326	319	331	464	352	427	848	467
Metals									
Aluminum (Al)-Total	189	174	165	180	457	422	404	524	86
Antimony (Sb)-Total	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Arsenic (As)-Total	0.267	0.259	0.206	0.209	0.542	0.235	0.200	0.437	0.100
Barium (Ba)-Total	14.1	13.7	11.8	12.2	29.3	15.8	14.9	34.5	5.20
Beryllium (Be)-Total	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30
Bismuth (Bi)-Total	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30
Cadmium (Cd)-Total	0.050	0.052	0.061	0.064	0.078	0.074	0.071	0.155	<0.030
Calcium (Ca)-Total	1350	1330	1550	1550	1630	1630	1580	2170	702
Chromium (Cr)-Total	0.98	0.95	2.08	2.27	2.22	3.37	3.19	2.44	0.61
Cobalt (Co)-Total	0.26	0.26	0.35	0.37	0.93	0.64	0.57	1.75	0.20
Copper (Cu)-Total	1.86	1.98	1.35	1.46	6.92	2.68	2.35	7.37	1.19
Lead (Pb)-Total	0.28	0.28	0.22	0.24	0.41	0.45	0.40	0.45	0.16
Lithium (Li)-Total	<0.50	<0.50	<0.50	<0.50	<0.50	0.65	0.61	0.74	<0.50
Magnesium (Mg)-Total	844	830	824	860	870	993	929	1350	282
Manganese (Mn)-Total	139	134	168	169	229	207	197	269	76.0
Mercury (Hg)-Total	0.0301	0.0362	0.0479	0.0556	0.0651	0.0535	0.0434	0.0535	0.0163
Molybdenum (Mo)-Total	<0.050	<0.050	0.058	0.057	0.122	0.115	0.103	0.116	<0.050
Nickel (Ni)-Total	1.30	1.23	1.58	1.69	4.19	3.45	3.12	5.99	0.91
Selenium (Se)-Total	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Strontium (Sr)-Total	4.93	4.79	4.60	4.61	5.04	4.85	4.65	11.9	1.84
Sulfur (S)-Total	346	315	334	344	1100	366	368	1320	353
Thallium (Tl)-Total	<0.030	<0.030	<0.030	<0.030	0.057	<0.030	<0.030	0.035	<0.030
Tin (Sn)-Total	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Uranium (U)-Total	0.035	0.034	0.051	0.056	0.096	0.106	0.098	0.214	0.015
Vanadium (V)-Total	<0.50	<0.50	<0.50	<0.50	1.00	0.83	0.76	1.19	<0.50
Zinc (Zn)-Total	55.3	56.2	50.3	52.9	43.8	38.4	35.7	52.1	12.0

Appendix 6. Lichen Lab Analysis Data
2008 Chemical Analysis of Lichen Tissue

Station Name	AQ-122 CC2	AQ-122 PE1	AQ-107 CC1	AQ-107 CC2	AQ-107 PE1	AQ-49 CC1 (DUPLICATE)	AQ-49 CC3 (DUPLICATE)	AQ-54 PE1 (DUPLICATE)	AQ-54 PE3 (DUPLICATE)
Date sent to Lab	30-DEC-08	30-DEC-08	30-DEC-08	30-DEC-08	30-DEC-08	31-DEC-08	31-DEC-08	31-DEC-08	31-DEC-08
Time Sampled	14:16	14:16	14:26	14:26	14:26	12:39	12:39	12:45	12:46
ALS Sample ID	L723635-100	L723635-101	L723635-102	L723635-103	L723635-104	L723635-105	L723635-106	L723635-109	L723635-110
Anions and Nutrients									
Total Nitrogen by Leco	0.33	2.81	0.38	0.39	2.58	0.40	0.33	2.11	2.13
Sulfate	434	1500	453	453	1610	511	357	382	437
Metals									
Aluminum (Al)-Total	212	405	118	117	248	254	219	294	279
Antimony (Sb)-Total	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Arsenic (As)-Total	0.239	0.783	0.230	0.246	0.558	0.181	0.183	0.367	0.354
Barium (Ba)-Total	11.9	43.7	8.72	9.06	27.6	29.2	25.9	43.4	40.8
Beryllium (Be)-Total	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30
Bismuth (Bi)-Total	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30
Cadmium (Cd)-Total	0.035	0.412	0.055	0.053	0.070	0.049	0.043	0.060	0.059
Calcium (Ca)-Total	1690	2620	1570	1600	1930	2210	2070	1410	1380
Chromium (Cr)-Total	1.48	1.39	0.70	0.72	1.05	4.66	4.42	0.67	0.60
Cobalt (Co)-Total	0.46	2.39	0.43	0.44	1.09	0.29	0.26	0.88	0.87
Copper (Cu)-Total	2.71	12.2	2.32	2.33	6.94	1.40	1.32	5.62	5.60
Lead (Pb)-Total	0.37	0.62	0.30	0.30	0.28	0.31	0.27	0.50	0.47
Lithium (Li)-Total	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Magnesium (Mg)-Total	704	1070	879	887	940	936	933	699	700
Manganese (Mn)-Total	178	214	223	228	251	176	164	104	107
Mercury (Hg)-Total	0.0445	0.0413	0.0281	0.0495	0.0683	0.0504	0.0455	0.0765	0.0551
Molybdenum (Mo)-Total	0.053	0.375	<0.050	<0.050	0.070	0.072	0.071	0.111	0.120
Nickel (Ni)-Total	2.06	9.46	0.80	0.86	3.20	3.13	3.04	4.43	4.19
Selenium (Se)-Total	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Strontium (Sr)-Total	4.32	30.3	3.69	3.77	6.71	7.89	7.25	9.89	9.34
Sulfur (S)-Total	361	1800	363	362	1440	359	324	930	927
Thallium (Tl)-Total	0.039	0.051	<0.030	<0.030	0.036	0.033	0.030	0.059	0.060
Tin (Sn)-Total	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Uranium (U)-Total	0.034	0.103	0.027	0.027	0.069	0.027	0.026	0.033	0.029
Vanadium (V)-Total	<0.50	0.89	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Zinc (Zn)-Total	29.3	70.3	38.2	38.0	59.3	42.8	40.2	69.7	69.5